

Dogs of War

POPULAR MECHANICS MAGAZINE



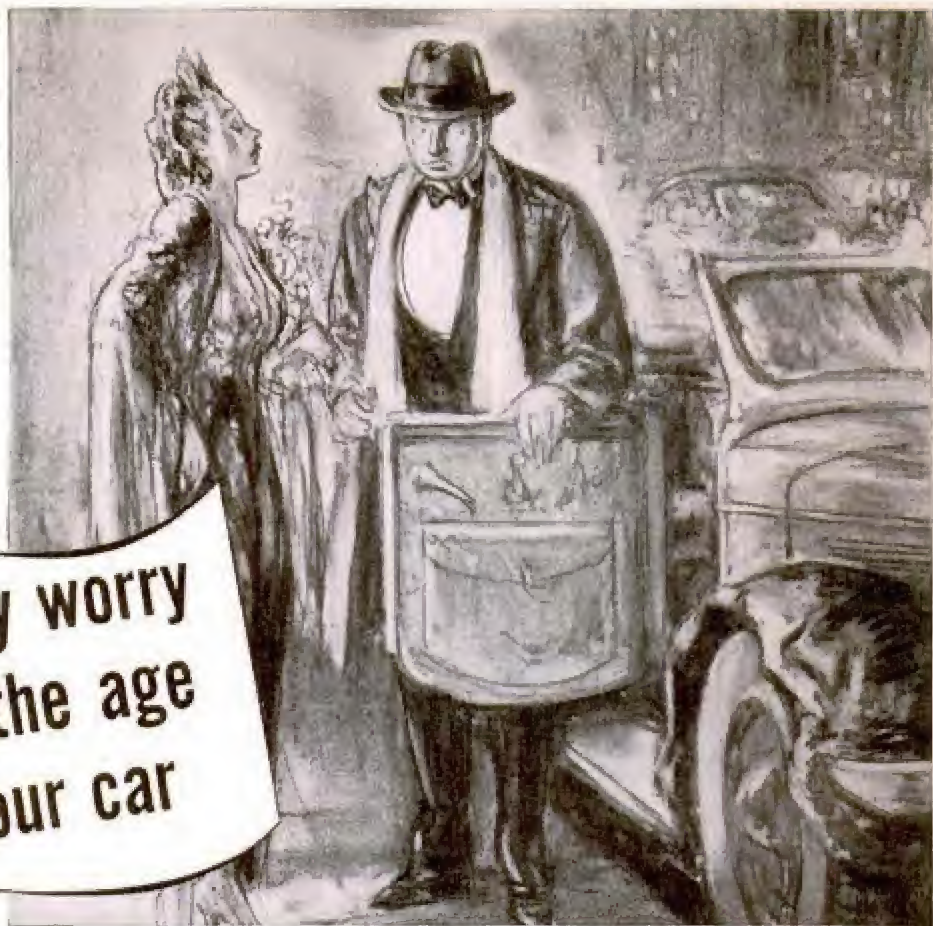
WRITTEN SO YOU CAN

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SEE PAGE 45



You may worry
about the age
of your car

but here is one worry you can avoid

WHEN Uncle Sam said, "No new cars this year," he also meant "The car you own has got to last a long time—every precious part of it!"

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Bad medicine for big bombers

ONE WAY to spoil a bomber's aim is to hang a curtain of steel over your ship and dare him to come down through it. To get that curtain of steel up there requires quick-firing, flexible guns.

To the plant of the Westinghouse Electric Elevator Company the Navy, a few months ago, brought its plans for such a gun. And to Westinghouse was given the important job of building the mounts that would control the aiming of these batteries of quick-firing guns.

Today, over that Westinghouse plant, there floats the Navy's "E" pennant—for excellence—testimony to the manner in which this Westinghouse plant did the job. How was this plant able to get into growing production of these mounts so quickly? The answer lies in a Westinghouse characteristic called "know how"—the ability to get things done in the best possible way.

This Westinghouse "know how" makes itself felt wherever Westinghouse craftsmen build things. Whether for the common defense or the general welfare, this "know how" is doing a job. The same skill and ingenuity that made so many splendid things for peacetime living are now being applied to many important war weapons.

"Know how" will work for you again

We look forward to the day when we can give your home, your farm, or your factory the full benefit of Westinghouse "know how" again. To speed that day means just one thing to us: to produce, in ever increasing quantities, the tools with which to get the victory job done.

Westinghouse

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Equipment

For the General Welfare

Air Conditioning
Electric Refrigerators
Electric Irons

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Lamps
Motors and Controls

These lists mention only some of the many thousands of Westinghouse products.

Westinghouse Electric & Manufacturing Co., Pittsburgh, Pa.

Cope, 1042, Westinghouse Electric & Manufacturing Co.

This One



F4JR-A7J-2W43

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“Let's give vital war calls the right of way and make equipment go as far as possible, saving copper and other materials for the war.”

BELL TELEPHONE SYSTEM



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Popular Mechanics Magazine

Registered in U. S. Patent Office and Canada

H. H. WINDSOR, Founder

H. H. WINDSOR, Jr., Editor and Publisher

June, 1942

Vol. 77, No. 6

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'Black Light at Your Service

NEXT month's Coloroto section is a blueprint for black magic. It tells how to make a ghost of yourself and your party guests with a bit of vaseline and an ultraviolet lamp, how to hang a weird fluorescent halo over a portrait on the wall, how to dress up the bric-a-brac cabinet with dull rocks and cheap vases that bloom into lovely luminous colors and vivid patterns under a hidden "black light" bulb. You can play with black light for 50 cents or \$50, and its bag of tricks is bottomless. With the story there will be eight pages of color photographs.

The Main Line Goes to the Front

BEFORE the blitz in Europe, passenger traffic on the railroads is suspended. It's not like that here. The Quartermaster General tells the railroads an Army division, 15,000 men and equipment, is to move in 48 hours. The railroads assemble a fleet of locomotives and cars and do the job. Read "The Iron Horse Delivers the Tools of War" in the July issue.

MEET the 1942 M. P. He's not just a gruff, club-wielding army cop; something new has been added—brains! The new style army policeman is learning law from lawyers, marksmanship from the army's crack shots; intelligence tests and the psychology of handling people are part of the training. But they also learn tricks of body leverage: how to wrest away a gun pointed at your stomach, or send your assailant flying when he has you on your back. Read in the July issue how our M. P. has improved on jujitsu.

Life on the Stars?

MAYBE there is life on other worlds. Fish with gyroscopic stabilizers swimming in an ammonia ocean. Animals that roll like a barrel. Lighter-than-air birds made buoyant by hydrogen, flying by jet propulsion. People living in an atmosphere of laughing gas, their blood streams circulating refrigerating fluid. Next month a noted scientist offers intriguing answers to the question: "Is There Life Among the Stars?"

War Study on the Air

TIMES SQUARE is "bombed" for the television screen, and thousands in the New York area listen and look as the scene moves across their home sets. They are "rookies" of the civilian defense army—fire wardens and rescue workers, learning the job in this new way. "Television Trains the Home Guard," in July, tells of this home-study school for war.

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Wake up Sleepy Motors



with
**CHAMPION
SPARK PLUGS**

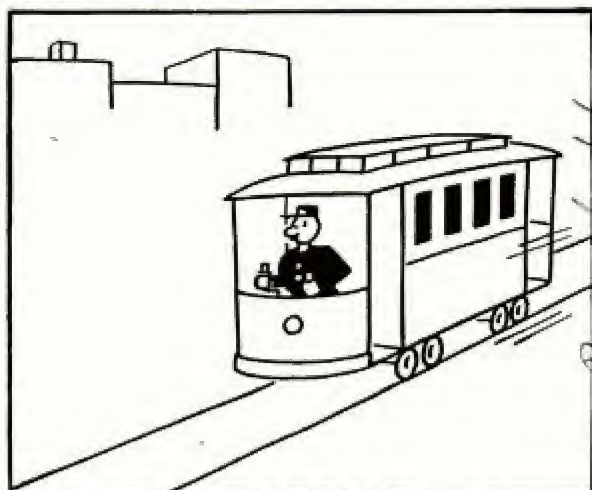
Wake up your sleepy motor—step-up gasoline mileage to the maximum by having your spark plugs tested, cleaned, and re-gapped at regular intervals.

When should spark plugs be changed? That varies, as most any spark plug will continue to function in a hit or miss, wasteful and inefficient manner almost indefinitely. But why continue wasting gas with old, worn-out, carbon encrusted spark plugs, and why put up with sluggish, inefficient performance when new Champions will rectify these troubles—which usually occur after 10,000 miles of service?

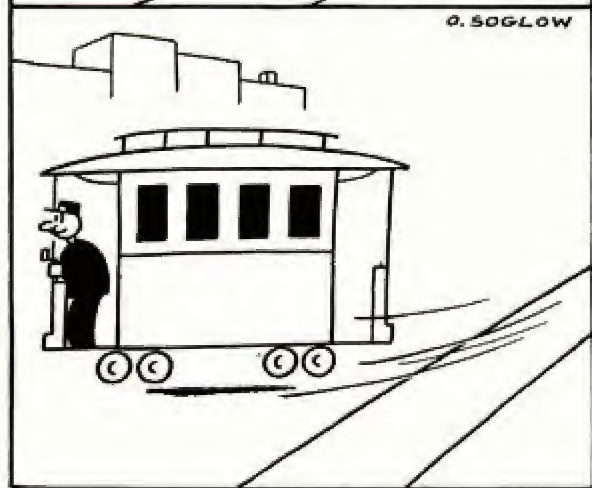
Have your spark plugs checked today. If you need new ones insist on dependable Champions the only spark plugs with the Sillment seal which prevents harmful gas leakage *common to ordinary spark plugs*. Since leakage in spark plugs causes over-heating, pre-ignition and rough, wasteful engine operation, it's decidedly to your advantage to insist on Champion Spark Plugs for champion performance.



TO SAVE GASOLINE • KEEP YOUR SPARK PLUGS CLEAN



G. SOGLOW



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Business Demands Accountants



... because Accountants Command Business

Accountants are usually in demand—at better than average earnings.

But today—more than ever before—the competent accountant finds his services at a premium.

Business in war has tightened up the reins and is watching costs—prices—every move—striving to operate on that basis of close control so essential to service and profits.

Then, too, business is working under tighter government regulations, with many more records and reports—war production, priorities, more and larger taxes, wage and hour laws, payroll deductions for Defense Bonds, etc., etc.

The Home Study Way to Accountancy Success

Thousands upon thousands of men have trained for Accountancy with LaSalle—at night—at home.

Their success—their progress—is a matter of record.

Whether their goal was a C. P. A. certificate or advancement in business, our files are full of letters reporting income increases far out of line with the time and cost investment.

Note for instance, these six cases out of many we might cite. (Names on request.)

A cost clerk, J. S. H. became, after completing 30 training assignments, cost accountant. Within nine months, only half through the course, he became chief cost accountant with a salary nearly four times what it was when he enrolled. C. K. was an immigrant day laborer. Within a few months he secured a bookkeeping job. Within a year, he secured three raises. In two years, he was in charge of his company's accounting department, although not yet through the training. W. J. F. moved up from store clerk to assistant bookkeeper after the first ten lessons. Now he is office man-

ager. S. W. N. knew nothing about bookkeeping. With 19 months of training he passed the C. P. A. examination on first attempt and opened his own public accounting office. Although a university graduate, P. M. was a grocery clerk at small wages. Today he is Secretary and Credit Manager with an income 300 per cent higher. Already in cost work, G. N. P. within nine months was earning 40% more; within two years, 100% more. The third year his income went up still more. Now he is manager.

These Men Won Success in Ordinary Times —You Have War Opportunities

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2. Have you determination?
3. Can you see and grasp an opportunity?

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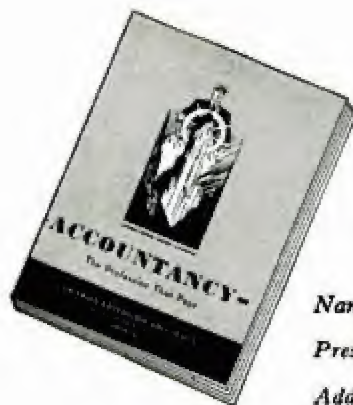
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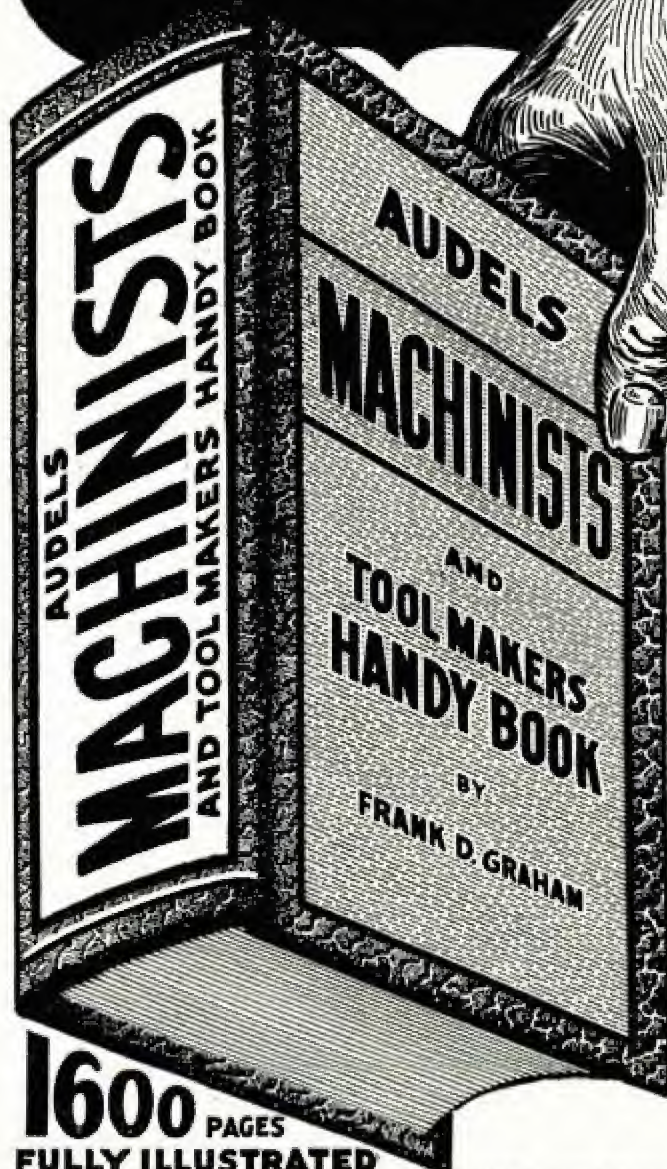
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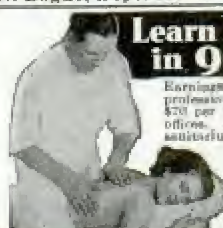
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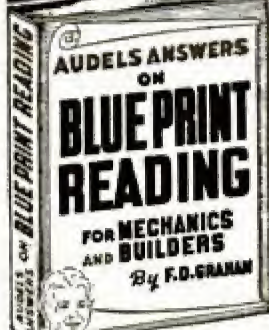
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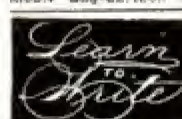
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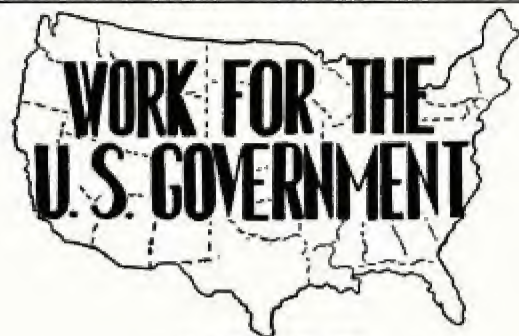
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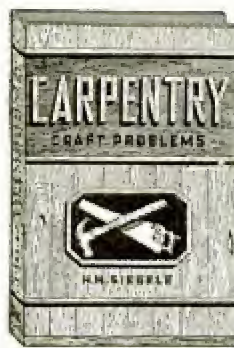
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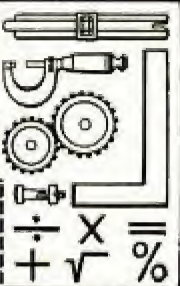
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FREE Water and our concentrates, makes flavors, lotions, shampoos, 72 products, labels, bottles furnished. Qualco, P-20030 Russell, Detroit.

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TIRES. Autocop stops thieves cold, protects whole car. Sample \$1.75. Autocop, B 20030 Russell, Detroit.

VITAMINS — High potency capsules. Write for sales plan or send 50c for full size box and agent's offer. George Belido, 30 Church St., New York.

BIG Daily profits selling Fifth Avenue ties, hose, belts, etc. Big free catalogue. Danforth, Dept. P-105, 545 Fifth Avenue, New York City.

SELL Tire locks. No wheels to balance. Servwell Products, Cleveland, Ohio.

BIG Money taking orders; shirts, ties, hosiery, underwear, pants, jackets, sweaters, uniforms, etc. Sales equipment free. Experience unnecessary. Nimrod, 4922-AN Lincoln, Chicago.

SPECIAL Shoe offers bring quick sales, easy money. To \$2.50 per sale plus bonus. Sell full—part time. Free sample shoes to producers. Exclusive opportunity. No investment. Free outfit starts you. Merritt Shoes, A-11, Brockton, Mass.

LORD'S Prayer on a real penny. Sells on sight. Full particulars and samples 25c. Perkins, 4745 Broadway, M-6, Chicago.

LEARN "How to Sell by Mail." 25c (None free). Rochester Publications, Box 54, Dept. 1B6, Rochester, N. Y.

HOUSEHOLD And wagon salesmen! Shortage of standard drinks this summer means big profits in household beverage trade. Sell first really new home beverage drink in ten years. Delicious, sensational, different, new taste thrill, highly concentrated. Steady repeat profits. Send 25c for full size sample and complete details. General Fruit Products, Desk P. Point Pleasant, New Jersey.

ENGRAVED Name plates, etc., a brand new line, large profits. Brett Bros., Winthrop, Mass.

BIG Profits selling Shelton Dust Absorbers. Samples 6—\$1.00 prepaid. Shelton Mfg. Company, Colorado Springs, Colorado.

GREETING Cards, specialties. Hildebrand's 4554 North Uber Street, Philadelphia.

AGENTS. Big line including food products. Fast selling premium and bargain deals. Low prices. Send card for big outfit offer with gift. Ho-Ro-Co, 2715 Dodier, St. Louis, Mo.

AGENTS—To mail our literature. Good profits. Home business. Maywood, 1133 Broadway, New York.

AGENTS: Stamping names on pocket-key protectors. Sample check with your name, address, 25c. Stamping outfits. Emblem checks, check-fobs, name plates. Hart Mfg. Co., 303 Degraw St., Brooklyn, N. Y.

AGENTS—300% Profit selling gold leaf letters; stores and offices. Free samples. Metallic Letter Co., 438-B North Clark, Chicago.

AMBITIOUS School seniors—Sell classmates the "tops" in graduation name cards. Best commissions. Free cards. Agencies going like wildfire. Hurry! Craftcards, Box 235-L, Pittsburgh, Penna.

WINDOW Sign letters. New "Roman" style. Large sizes, penny each. Absolutely beautiful. Free samples. New catalogue. Atlas, 7941 Halsted, Chicago.

THIS Man's idea is a God-send to folks who need money. Laugh at "War-Pig." 25c complete. You make 1000% profit. Money back without question if not entirely satisfied. Send quarter to Ontario Enterprises, U. S. Post Office Box 575, Desk A25, Rochester, New York.

DIETHYL Super! Sensationally new! Make 500%! Saves millions! Needed everywhere! Free offer—information—write. Thermodes, Peoria, Ill.

GAS Stations want this new patented necessity. Knipp, Long Beach, California.

GOOD Paying business silvering mirrors, plating autoparts, reflectors, bicycles, bathroom fixtures by late method. Free particulars and proofs. Gunmetal Co., Ave. N. Decatur, Ill.

BIG Money applying initials on automobiles. Easiest thing today. Free samples. If you sell printing and advertising specialties we have an excellent sideline featuring Decalcomania name plates in small quantities. "Ralco," 727 Atlantic Ave., Boston, Mass.

DO You want agents for your proposition? Your ad in this space will place your message before hundreds of men seeking fast-selling products. My folder "How to Secure Agents," is filled with proof. I'll gladly send you a copy free. P. W. Johnson, Manager Classified Advertising, Popular Mechanics Magazine, 200 E. Ontario St., Chicago.

HIGH-GRADE SALESMEN

SELL Everyday greeting cards! Liquidating 3,000,000 profitable sellers! Bulletin free! Sample box 25c. Elfeo, 438 North Wells, Chicago.

EVERY Merchant prospect simplified business records. Matz Products, Reading, Pennsylvania.

SALESMEN: America's finest sideline. 40% commission daily. 1000 fast selling repeat items. Every business uses and must buy. No investment. Sales portfolio free. David Lionel Press, 312 So. Hamilton, Dept. 78, Chicago.

SALESMEN—200% Profit. Sell stores, new 10c collar support every man needs. Free merchandise offer. Hawkins, 537 S. Dearborn, Chicago.

WARTIME Makes our essential business necessities sell fast. Not affected by priorities. Large commissions advanced daily. Experience unnecessary. Samples free. Northwestern, 621-O Jackson, Chicago.

ADVERTISING Book matches. America's largest manufacturer of union label book matches. Fast selling line. Large sales producing kit. Sample matches. Complete cut catalog, 13 color combinations makes selling easy. Commission in advance. Superior Match Company, 7530 Greenwood, Dept. N-6, Chicago.

MAKE—Sell made-to-measure arch supports. Particulars free. Corssen, 3609P Texas, St. Louis, Missouri.

MAN With car to establish retail store route. Openings almost every locality. Handle orders for nationally known manufacturer-jobber. Average 50% commission. Steady big pay opportunity. Sales experience unnecessary. World's Products Co., Dept. 108, Spencer, Ind.

BIG Commissions—selling to stores celluloid pricing tickets, metal shelf moulding. To restaurants, menu covers, signs. P. Pricing Press, 124 White St., New York.

ADVERTISING Book matches offer liberal earnings—full, spare time. Experience unnecessary. Factory direct. Low prices, high quality, quick deliveries, powerful patriotic display, repeats. All business firms prospects. Free kit, instructions. American Match & Printing Co., Dept. 66, 4822 South Trumbull Ave., Chicago.

FAST Sideline. 7 items top our sales this spring. No priorities! Real money makers for experienced advertising specialty salesmen with following among business men. Give experience and territory covered. Newton Mfg. Co., Bin DA, Newton, Iowa.

HOT Sideline for active salesmen. Midwest Finance Corp., Dubuque, Iowa.

NEW Specialty—Sells every business and professional man. Four \$15 sales daily pay \$270 weekly. Farrell cleared over \$1,000.00 monthly. Write, P. E. Armstrong, President, Dept. PM, Mobile, Ala.

EDUCATIONAL AND INSTRUCTION

WELDING Opens the way to good pay and future in important industries. Growing need for trained welders. Prepare now. Practical, personal training spare time at home and Chicago. Write for free facts. Utilities Engineering Institute, 1314 Belden, Dept. 128, Chicago.

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WELDING—Electric arc. Learn profitable trade quickly through actual practice. Individual welder instruction at bare cost of materials. Full particulars free. Valuable welding lessons book 50c. Hobart Welding School, Box M-622, Troy, Ohio.

NEW Writers needed! Free test shows your ability. It's fun. No obligation. Rush postcard to Comfort Writer's Service, Dept. 786-Q, St. Louis, Mo.

RESORT Hotel positions. Instructions. Lee Institute, 505A Bristol Building, Boston.

HOME Study course, drugless therapy. Free literature. Inst. of Drugless Therapy, Tama, Iowa.

SHORTHAND Typewriting course. Sensational. 25c. Jones, 1210P Dudley, Utica, N. Y.

ELECTRICIANS Urgently needed! Free book tells how to qualify. Write today. Electric Institute, Dept. B, Hinsdale, Ill.

STREAMLINED Accounting course. Inexpensive. Cantrell's Institute, 1002 Berkeley, Pueblo, Colorado.

DANCING Made easy! Diagrammed home course. Sample lesson 25c. Ludwig's, 532 Geary, San Francisco.

HOW To get a job! Information free. Guidance Service, Box 175, Crosby, North Dakota.

CLINICAL Laboratory technic taught in your own home. Practice outfit supplied. Bulletin free. Imperial Technical Institute, Box 973-E, Austin, Texas.

LEARN Telegraphy! Splendid opportunities now prevail. All expenses low. Catalog free. Dodge Institute, Dept. M, Valparaiso, Indiana.

RADIO Engineering, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge Institute, Dept. R, Valparaiso, Ind.

SECRET Investigation. Experience unnecessary. Detective particulars free. George Wagner, M-2640 Broadway, N. Y.

LOCKSMITH Course. Lock picking, key fitting, etc. \$1.00 prepaid. Locksmith, Canadian, Texas.

BECOME A Doctor of Psychology (Ps. D.) Teach secret of contentment, happiness. Solve mental worries. Free book. College of Universal Truth, 20-B East Jackson, Chicago.

6,000 WRITERS Wanted. New, undeveloped field. Overton, 712 Diversey, Chicago.

ARC And spot welders. Make them yourself. Very simple. Inexpensive. Complete details 25c. Popular Mechanics Press, Dept. 402, 200 E. Ontario, Chicago.

CARTOONING, COMMERCIAL, ART, SHOWCARD WRITING, SIGN PAINTING

CARTOONING Course—36 lessons, 6 booklets, 816 illustrations, 100 markets, personal criticism \$2.45. Templeton, 146 Wellington, Elgin, Illinois.

LEARN Cartooning from newspaper cartoonist. Many drawings with explanation. \$1.00. "Batch," 2110 W. Bdwy., Enid, Okla.

EARN Money, copying and duplicating comic cartoons for advertisers. Ad-Service, Argyle, Wisconsin.

CARTOONING Course—30 illustrated lessons, over 500 sketches, \$1.00 postpaid. Montes Studio, Box 985, Pasadena, Calif.

"PAINT Expert Signs Without Experience." Send 50c for our new library endorsed, complete, simplified lettering course. It's mechanical. Get it today. Use it tomorrow. Satisfaction guaranteed. Haines Sign Service, Sabina, Ohio.

PEN And ink drawings. Let us draw your advertising and catalogue illustrations, from photos, copies or objects. Best work and fair prices. Heraldic Studios, 1914P Oakdale Avenue, Chicago, Ill.

GONE Is color guesswork. Let an expert select the right colors for you. Send 50c for the Color Helm, Model No. 102. Free folder about color. Flatelle, Inc., Ridgewood, New Jersey.

ADVERTISING AGENCIES, LETTER WRITERS, FOR ADVERTISERS

24 WORDS, 40 Newspapers \$2.00. Good-all, 37 Gardner, Vallejo, California.

MAIL-ORDER Or agent ad reaching 1,000,000 families throughout United States \$14.00 inch. Newspaper, magazine, mailing-list, rate-book, free. Chicago Advertising Agency, 20-PM West Jackson, Chicago.

ADVERTISE: 24 Words, 149 newspapers, \$6.50. Lists free. Advertising Bureau, 4515-C Cottage Grove, Chicago.

IDEA Cut service, inexpensive, for advertisers, printers, publishers. Proofs free. Harper, 209 South High, Columbus, Ohio.

FREE—New Advertisers Rate Guide. 44 pages. Includes everything. Lowest rates. E. H. Brown Advertising Agency, Merchandise Mart, Chicago.

ADVERTISING Placed all magazines, newspapers U.S.A., Canada. Lowest rates. Free service. 54-page catalog free. Baker Advertising Agency, A-189 W. Madison, Chicago. Established 29 years.

BUSINESS SERVICE

CHICAGO Mail address: \$1 monthly—Receiving, reforwarding your business, personal mail. General, 30 West Washington, (Established 1919).

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2 LINE 25c, 3 Line 35c. M. Struble, Cupertino, California.

ILLINOIS Rubber Stamp Works, 2913 PM No. Rockwell, Chicago. Catalog free.

SUPERIOR Natural rubber. Two lines 30c, three 40c, four 50c. Slocum, 814 Bradley, Peoria, Ill.

QUALITY, 4 Lines 45c. Federich Company, Box 412-S, East-Pittsburgh, Penna.

KNOB Handle, cushioned, 2 lines 30c, 3-40c. Stamp Works, Centerport, N. Y.

3 LINES 27c; Cushioned, indexed, 35c. Signatures \$1.50. Stamprite, Wauwatosa, Wis.

2 LINES 25c, 3 Lines 35c. Stamp Works, Auburn, Nebr.

TYPEWRITERS, DUPLICATORS, OFFICE DEVICES

TYPEWRITERS, Adder, mimeograph, multigraph, addressograph. Send for free lists of machines that will help you at half price. Pruitt, 28 Pruitt Bldg., Chicago.

PRINTING OUTFITS AND SUPPLIES

PRESSES, Type, cabinets, supplies, List for stamp. Lincoln Press, 220-J Hartwell, Fall River, Mass.

PRINT Your own cards, stationery, circulars, advertising. Save money. Simple rules furnished. Print for others, nice profit. Junior outfit \$8.25, senior outfits \$17.38. Details free. Kelsey, Inc., T-11, Meriden, Conn.

INEXPENSIVE 6x9 Printing press. Details free. Novelty Shop, Downsview, La.

PRINT At home. 10c will bring a complete catalog of presses, type and supplies. P. Feiffer & Company, 9 Columbia St., Newark, N. J.

BARGAINS — Presses, type, supplies. Send stamp. 159 Harvard, Cambridge, Mass.

USED Presses, type, supplies. Lists 3c. Turnbaugh Service, Loyalville, Penna.

PRINTING, MULTIGRAPHING, MIMEOGRAPHING, GUMMED LABELS

WEDDING Invitations 100—\$3.50 up. Samples, 4154 N. 5th, Philadelphia.

150 EACH—8½x11 Letterheads, 6½ envelopes, \$1.50. John Ferreira, 220 Almy St., New Bedford, Mass.

MIMEOGRAPHING. Letter size, thousand \$3.00 prepaid. Richmond, 2733 North Richmond, Chicago.

5000 LOTS Elegant envelope slips, \$3.75; 6x9 circulars, \$8.25; postcards, \$9.00; folders, \$10.00. All printing low prices. Samples. Goodprint, Harrisonburg, Va.

250 CARDS (Name, address, telephone), and attractive wallet card case \$1.00. Zinnsmith Press, 161 Grand St., New York, N. Y.

ENVELOPES, 6½ Printed, \$3.00 thousand. Also job printing. Clipper Printing, 4114 Brooklyn, Kansas City, Mo.

PERSONAL Stationery, 100 sheets, 100 envelopes \$1.25. C.O.D. orders accepted. Victory Service, Emmaus, Penna.

WHOLESALE—Colored statements, letterheads, matching envelopes. Example: 200 letterheads, 100 envelopes, 79c. Thousands pleased! Write: Printing Dept., Vinmar Paper Co., Thompsonstown, Penna.

1000 ENVELOPE Slips \$1.50; 5000—\$3.75. Everything printed—lowest prices. Samples? Thriftprint, Box 318, Chicago.

100 8½x11 LETTERHEADS And 100 envelopes \$1.00 postpaid, 100 business cards 50c. Crowe, Box 1365, Baltimore, Md.

1000 DISTINCTIVE Letterheads, envelopes \$5.50. Pricelist. Davis Press, Webster, Mass.

"NO Lineage Limit" Mimeographing—300 letters or 300 postcards \$1.00. Dollar Letter service, 180 West Washington, Chicago.

1000 FINEST Business cards, \$1.49. 5000 6x9 circulars \$7.89. Globe Printing, Youngstown, Ohio.

5000 6x9 HANDBILLS, \$5.00. Liberty Press, Box 493, Indianapolis, Ind.

\$1.00 POSTPAID Each, 200 letterheads, envelopes, statements or cards. Benneville, 907 West Roosevelt, Philadelphia.

1000 6x9 CIRCULARS, \$2.95. 5000 3x5 Circulars \$3.75. Postpaid. Stationery, booklets, publications. Samples. Low prices. Address, Chelsea, Oklahoma.

1000 BUSINESS Cards attractively printed with modern type faces \$1.21 postpaid! Highspire Press, RR-1B, High Spire, Penna.

GET Prices, samples for next envelope or printing job from Transamerican, 514 Shelby, Detroit, Michigan.

ENVELOPES: All sizes. Jack's Printing Service, Box 5450-Metropolitan Station, Los Angeles, California.

5000 6x9 CIRCULARS \$8.00. All printing reasonable. Samples, Specialty Sales, 3064 Fifth, Chicago.

PERSONAL Stationery, 100—6x8½, single white sheets and matching envelopes, with name and address in rich blue—Only \$1.00. Order now, or write for samples. L & L Specialty Co., 407 East Fifth St., Royal Oak, Michigan.

EVERYTHING Printed, wholesale prices. Free list. Midwestern Printing Co., Springfield, Missouri.

500 3x5¼ FOUR Line gummed stickers, 25c. Moritz Printery, Saginaw, Mich.

JOB Printing. Quick, reasonable. Samples. Atlantic, Box 653-H, Rock Hill, S. C.

WANTED Printing of all kinds by thousands of our readers. Your ad in this space will bring you some nice orders. Write for positive proof. F. W. Johnson, Classified Advertising Manager, Room 304, 200 East Ontario Street, Chicago.

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INVENTORS: Take first step toward protecting your invention—without obligation. Write for free "Record of Invention" form for establishing date of invention and free "Patent Guide for the Inventor"—telling about confidential search service; how to sell and market inventions; details of convenient payment plan. Send today for free "Patent Guide" and "Record of Invention" form. Clarence A. O'Brien and Harvey Jacobson, Registered Patent Attorneys, 21B-F, Adams Building, Washington, D. C.

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INVENTORS—Patent your invention. Secure book, "Protect, Finance and Sell Your Invention." No obligation. McMorro and Berman, Registered Patent Attorneys, 134-D Barrister Building, Washington, D. C.

"INVENTOR'S GUIDE," 100 mechanical movements, free; advises on patenting, selling inventions. Frank W. Ledermann, 154 Nassau Street, New York.

PATENTS. Protect your idea by securing free "Proof of Invention" folder. International personal service. Established 1904. E. E. Vrooman, 871 Woodward Bldg., Washington, D. C.

L. F. RANDOLPH, 302-B Victor Bldg., Washington, D. C. Low cost. Book and information free.

PATENTS. Booklet free. Highest references. Best results. Promptness assured. Watson E. Coleman, Patent Lawyer, 724 Ninth St., Washington, D. C.

INVENTORS—Before disclosing your invention to anyone send for form "Evidence of Conception"; "Schedule of Government and Attorneys' Fees" and instructions. Sent free. Lancaster, Allwine & Rommel, 411 Bowen Building, Washington, D. C.

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INVENTORS:—Have you a useful, non-military invention for sale? Practical new ideas, patented or unpatented, urgently needed by manufacturers and consumers. Write for details. Chartered Institute of American Inventors, Dept. 4-A, Washington, D. C.

I SELL Patents. Established in 1900. Charles A. Scott, 773PM Garson Ave., Rochester, N. Y.

CASH For practical ideas and inventions. Mr. Ball, AB-9441 Pleasant, Chicago.

INVENTORS: Sell your invention yourself! Write: Crompton, 99-M Owen, Detroit, Michigan.

SELL Your patent through a small classified ad in Popular Mechanics. Many inventors have found buyers in this way. Ask me for proof—I'll gladly send it to you. F. W. Johnson, Manager Classified Advertising, 200 E. Ontario St., Chicago.

INVENTIONS WANTED

MANUFACTURER Wants new invention or idea. Nelson, Dakota Bldg., St. Paul, Minn.

SELL Your patented, applied for, pending, invention quickly. Write: Universal Guaranty Company, Box 772, Lancaster, Penna.

WANTED—Meritorious patented, unpatented inventions. Booklet, references, free. Invention Reporter, 5B-11338 So. Fairfield, Chicago.

INVENTORS! Have you good, patentable idea? Write Metzler, Dep't 72-O, 11 West 42nd, New York.

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CASH For inventions, patented, unpatented. Mr. Ball, A-9441 Pleasant, Chicago.

MANUFACTURING

MODELS—Small lot manufacturing. Metals, plastics, etc. Milburn, Burlington, Kentucky.

MODELS AND MODEL SUPPLIES

RAILWAY Models, complete line informative catalogs O gauge, 112 pages, 25c; HO, 48 pages 15c. Walthers, 347 Erie, Milwaukee, Wisconsin.

STEAM Locomotives O gauge, engines, boilers. Circulars 10c stamp. Anton Bohaboy, 2297 Price St., Rahway, New Jersey.

SHIP Models and yacht supplies complete. Large 56 page catalogue 15c. Bill Wild's, 510 East 11 St., New York City.

SHIP Model kits and fittings. Complete line Fisher model yacht equipment. All Boucher, Fisher, Marine Model and Ideal kits, fittings and blueprints at catalog prices. Most complete stock in New England. James Bliss & Co., Inc., 220 State Street, Boston, Massachusetts.

NEW Model airplane motors \$3.35 each. Particulars stamp. Ace, 1017-PM North McBride, Syracuse, New York.

LATEST Engine catalog 25c. Refunded. Howards, A-2417 North Ashland, Chicago.

MINIATURE Steam locomotives, new catalog listing all builders' needs 25c. Little Engines, Wilmington, California.

CARVED Hull ship model kits. Ship and yacht model fittings; model yacht sails. Illustrated catalog 20c. A. J. Fisher, 1002-M Etowah Ave., Royal Oak, Mich.

HOME CRAFTSMEN

LATEST 1942 Plans and full easy instructions for 17-family Martin house (75c), goose and goslings lawn figures (25c), wall and corner shelves (25c), two wren houses (25c)—based on standard lumber sizes, with minimum waste, fewest operations, attractive new designs, unlike anything available. Special introductory offer. Send \$1 for all four. Money back if not satisfied. Jackson Studio, Dept. M6, Shorewood, Wis.

MAKE \$17.00 For 14 hours of spare time work. Assemble and sell Dillabaugh rowboats. I furnish material, parts, instructions. Write today for big money making proposition. C. R. Dillabaugh, 7932 Malloy, Portland, Oregon.

VENETIAN Blinds, supplies, machinery, wholesale. Catalog 10c. "Manufacturing Booklet" \$1.00. "Roberta," Gloversville, New York.

GET Free leathercraft instruction pamphlets, prices of leathers, tools, projects. Fascinating hobby. Make beautiful gifts. Leather samples 5c. Wilder & Company, 1938 Crosby, Dept. 6F, Chicago, Illinois.

CATALOG:—Decal transfers, handy hand tools, new power sander, patterns plywood novelties, lawn ornaments, silhouettes, letters and numerals. Other lines. 500 articles finely illustrated. Write today. Wo-Met Shop, Ashburn, Georgia.

MAKE Your own smoking pipe. Briar pipe blocks 25c each plus postage. Michelson & Sternberg, 116 Broad St., New York City.

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LEATHERCRAFTSMEN: Send 10c for new handbook and catalogue of tools and supplies. E. A. Sweet Company, Inc., Leathercraft Division, A-58, 148 State Street, Binghamton, N. Y.

28 LAWN Ornament patterns 25c. Other patterns: 15"-20" high; Dutch girl, Dutch boy, pirate, bull terrier, Mexican girl, Mexican boy, dwarf, penguin, flower girl, 10c each; 3 for 25c. 25 novelty patterns 30c. All 62 full size patterns \$1.00 postpaid. Strother, Box 383-DP, Belington West Virginia.

15 FULL Size what-not patterns 25c. 25 lawn ornament patterns 25c. Albright Service, M-6901 Railroad Ave., Omaha, Nebr.

BLACK-OUT Home for few cents quickly. Instructions 20c. Charles, 12-AC, Norwood, Ohio.

49 LAWN Ornament patterns. Dutch boy, Dutch girl, some 21" high 60c. 20 novelty patterns 30c. 20 silhouette patterns 30c. 69 patterns \$1.00. Modern Woodcraft, Saginaw, Michigan.

WOODWORKING Power tools— Make them yourself. Lathe, scroll saw, saw table, drill press, portable sander, bandsaw, motorized plane. Complete details only 25c. Popular Mechanics Press, Dept. 401, 200 E. Ontario Street, Chicago.

WATCHES, OLD GOLD, JEWELRY, ETC.

ZIRCONS—White diamond cut, 3 for \$3.50 (2 carats). List. Leuthold, 2227½ N. Alabama, Indianapolis, Ind.

GENUINE Diamonds, out-of-pawn prices, unredeemed loans and distress merchandise; men's, ladies' rings, one carat \$95.00, ½ carat \$45.00. Shipped for free inspection, appraisal. Send for free list, hundreds of beautiful diamonds, very low prices. Lloyd Butler, President, Prudential Loan Association, 133-EP North Clark St., Chicago.

GOLD Wanted! Old jewelry, bridge-work, watches, diamonds, etc. Honest appraisal, immediate cash. Leuthold, 2227½ N. Alabama, Indianapolis, Ind.

CASH! Gold, jewelry, teeth, coins, diamonds, mercury, etc. Ship! Simon's, 353 Old Arcade, Cleveland, Ohio.

ELGIN Waltham watches \$3.50. Make big money. Free watch and jewelry catalog. Plymouth Jewelry Co., 163-F Canal St., New York.

AGATES, Fossil woods, three pounds \$1.50 postpaid. Jay Ransom, Aberdeen, Wash.

WATCHMAKERS' Materials, tools, jewelry—bought, sold. Best prices for old gold, diamonds. Free catalog. Ben Segal Company, Box 150, Chicago.

HIGHEST Prices for old gold—Mail your teeth, watches, jewelry. 100% full cash value mailed day shipment received. Satisfaction guaranteed or articles cheerfully returned. Information free. Chicago Gold Smelting Company, 300-P Champlain Building, Chicago.

GOLD \$35.00 Ounce. Mail old gold teeth, diamonds, jewelry, watches. Receive cash by return mail. Satisfaction guaranteed. Free information. Dr. Weisberg's Gold Refining Company, 1500-Q Hennepin, Minneapolis, Minn.

5000 REBUILT Watches! Free catalogue—Diamonds, jewelry, (3c postage). The New York Jobbers, 74 Bowery, Dept. M, New York, N. Y.

GEMS, Agates, minerals, jewelry. Six rough gemstones—emerald, asphire, garnet, topaz, fireopal, agate, \$1.00 postpaid. Catalog. Hill Co., Route 7, Salem, Oregon.

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SAFETY Razor blades sharpened free. Send three as a trial—any make. Perfect shaving edge guaranteed—send only three cents postage. Independent Sales Company, Box 2912, San Diego, Calif.

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GUARANTEED Factory rebuilt transits and levels for sale (cash or terms) or rent (with purchase option). Large selection. Low prices. We will repair, trade or buy old instruments. Ship prepaid for estimate and valuation. For complete information write for list M-70. Warren-Knight Co., (Manufacturers of Transits and Levels), 136 N. 12th St., Philadelphia, Penna.

FOR SALE—MISCELLANEOUS

TWENTY Repossessed peanut, confection vendors. \$125.00. Box 1591, Rockford, Illinois.

YORK 4x4 Ammonia compressor and coils. Harold Mitchell, Leslie, Mich.

WANTED—MISCELLANEOUS

SUPERHEATED Steam engine, self starting, size—about 2" bore, 2.5" stroke, length 15.5", weight 35 pounds, variable expansion gear. Trippie, West Point Pleasant, New Jersey.

WANTED: Mercury (quicksilver.) We pay \$1.50 per pound. Send express insured. Western Metal Co., Bloomington, Illinois.

NEW Products wanted. Will consider developing now for postwar production—can be mechanical or consumers goods. Confidential, responsible, progressive machinery building and sales organization. Address P.O. Box 1034, Short Hills, New Jersey.

WANTED To buy: Your pictures. Write for details. Free market letter. Freelance Photographers Guild, Inc., 219 East 44th Street, Dept. P-6, New York, N. Y.

WILL Buy your unused United States stamps. Small discount. What have you? Mint Sheet Brokerage Co., 618 Caxton Building, Cleveland, Ohio.

MERCURY (Quicksilver), tungsten, molybdenum, cadmium, high speed tool steel, bismuth, purchased in any quantity. Write for quotations. Metallurgical Products Co., 35th and Moore Sts., Philadelphia, Penna. Established 1909.

NEW Products wanted. Will consider developing now for postwar production—can be mechanical or consumers goods. Confidential, responsible, progressive machinery building and sales organization. Address P.O. Box No. 1086, Short Hills, New Jersey.

HIGHEST Prices for used cameras, binoculars, microscopes, drawing sets, tools, any optical or scientific instrument. Satisfaction guaranteed. Gordon's, 162-M Madison, Chicago.

CASH For anything. Justice Jewelry Jobbers, 190 North Wells, Chicago.

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ARCH Supports custom made \$2.50 pair. impression material free. Nufect Co., 1472 Broadway, New York.

PARTY Fun galore! Novelty shipping tags to tie on coat lapels of party guests. 10c dozen. Martin Co., 7431 Tulane, St. Louis, Mo.

WIN Prize money—Booklet, "Successful Contesting," shows how. 10c postpaid. Bulletin listing \$100,000.00 prizes included. World Publishers, 4515-B, Cottage Grove, Chicago.

ART Pretty girl pictures. Fifty new series. Complete set 18 pictures \$1.00. Sample package 25c. Each picture full postcard size 5¼x3¼. Harlem, Box 10, Station J, New York, Dept. A-21-P.

AMAZE Your friends! "Mystery Book" of magic tricks shows how. Also new system character readings, plus ten startling actual tricks. \$1.00 postpaid. If ordered now, 10c defense stamp free! Ellis Antkes, Publisher, 131 West 42nd, New York City.

REVITALIZE Your scalp! Stimulate normal hair growth! Complete instructions \$3.00 (formerly \$15.00). Money returned if not delighted after five-day trial. L. Webb, Lithonia, Georgia.

HUMAN Analysis, find right job, etc., illustrated, 25c. NuAge Books, 3915 - 24th St., San Francisco, California.

Z-O-M "B" Complex vitamin capsules for vim, vigor and victory. Lowest cost—100 capsules \$2.00 postpaid. Send money order or currency. Zom Research Laboratories, 7309 Paxton, Chicago, Illinois.

TATTOOING Outfits. Write today. Zels Studio, 728 Lesley, Rockford, Illinois.

MEXICAN Legal matters. William Cocke, Reliable American Attorney, El Paso, Tex.

MISCELLANEOUS

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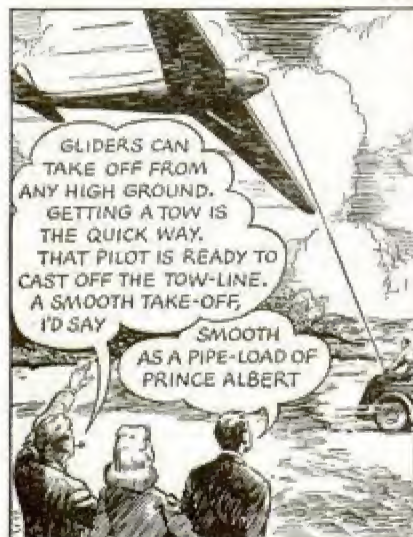
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WONDERS OF AMERICA

Silent Warbirds



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86 DEGREES COOLER

THAN THE AVERAGE OF THE 30 OTHER OF THE LARGEST-SELLING BRANDS TESTED—**COOLEST OF ALL!**



50 PIPEFULS OF FRAGRANT TOBACCO IN EVERY HANDY POCKET CAN OF **PRINCE ALBERT**

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CRIMP CUT LONG BURNING PIPE AND CIGARETTE TOBACCO

Popular Mechanics Magazine

REGISTERED IN U. S. PATENT OFFICE AND CANADA

WRITTEN SO YOU CAN UNDERSTAND IT

Vol. 77

JUNE, 1942

No. 6

POSSIBLY you have heard about the army convoy that was moving, bumper to bumper and without lights, through a blacked-out town. Someone on the sidewalk called out, "How in the world can you fellows see to drive in the dark?" From the direction of a jeep came a one-word reply: "Meow."

The jeep driver really did have cat eyes, even if he was joking. His diet included vitamin A that helps him see in the dark. In one sense, vitamins are as important in this war as are bullets or gasoline. Vitamin A, for example, is being used by night fighter pilots to help them spot enemy planes in the dark. It is given to pilots of dive bombers to check nosebleed. It helps prevent colds and other infectious diseases among defense workers.

The war has trebled our need for vitamin A, and at the same time the war has cut us off from Norway, formerly our chief source of vitamin-rich cod liver oil. When imports ceased, a frantic search was started for a new source of the vitamin. To everyone's sur-



This great basking shark weighed several tons, with a 700-pound liver that—while low in vitamin content—helped pay for its damage to nets

JUNE, 1942

1

*Emb. Thomas L. Simpson, Jr. / Los Angeles
3872 Franklin Ave.*



Harpoon gun and line for capturing sharks basking on surface Centrifuge to extract Vitamin A from oil

prise, investigators on the west coast discovered that we had been overlooking a source of vitamin A that is even richer than the cod. Soupfin sharks, they learned, have livers that are extremely rich in the substance. Livers of other species of sharks also contain vitamin A. A shark's liver amounts to one tenth or more of the creature's weight.

The result is that sharks, until now nothing but a nuisance to commercial fishermen, have become their most prized catch.

Prices shot upward and for a while fishermen who were lucky enough to make big hauls earned movie-star incomes. Fifteen hundred dollars a ton were paid for soupfin carcasses in San Francisco and a boatload of sharks sometimes netted \$20,000. Even a 10-year old youngster who hooked a soupfin from a wharf received \$45 for its liver.

The high prices were the result of speculation and today shark liver prices are being stabilized. The actual price paid for sharks now depends on the vitamin A content of the liver and this varies with the species, sex, season of the year, and locality in which the shark is caught. In Los Angeles, Truesdail Laboratories, Inc., is busy determining such variations in vitamin content and is testing shark-liver oils



Rich in Vitamin A, liver of this soupfin shark accounts for ten percent or more of its weight



Feeding Vitamin A to \$1,200 chinchilla in a program to determine the best vitamin rations for valuable animals

POPULAR MECHANICS

520 West Avenue

PHOTOGRAPH BY J. H. HARRIS

from as far away as the west coast of South America.

The importance of vitamins has been understood only in the last decade or so. Vitamins are substances that in small amounts are necessary for health, along with other foods such as proteins and carbohydrates. It is now realized that the sufferings of some of the early polar explorers were due entirely to lack of vitamins in their foods. To a certain extent the American population has been starving itself of the vitamins it needs.

This is because, explains Dr. Roger W. Truesdail, Americans who live in cities have come to insist on convenient packaged and refined foods in which much of the vitamin content has been lost. Likewise, most of us do little heavy manual work these days, hence we don't eat as much as we otherwise would and as a result our vitamin intake is low. It is estimated that less than a quarter of the population consumes the well balanced diets that contain all the vitamins a person needs. One out of every ten men who have been examined for selective service was found to be suffering from disabilities connected directly or indirectly with nutrition.

"A start has already been



↑
Medical men are improving the night vision of fliers by adding Vitamin A to diet. Here an engineer peers out of the test "cold chamber"



← At the left is a halibut, at the right a large rock cod. These are among the varieties of fish whose livers rank high in yield of Vitamin A

Keep this chart showing the sources of vitamins in common foods. It is an excellent guide for planning health-building meals in a wartime economy
↓

Nutrichart

VITAMINS IN COMMON FOODS					
(Compiled from the Nutrichart by Roger W. Truesdail, Ph. D.)					
FOOD	VITAMINS				
	A	B ₁	C	D	G (B ₂)
ORANGE OR LEMON JUICE	X	XX	XXX	...	XX
TOMATO JUICE	XX	XX	XX	...	XX
BREAD, WHITE	X	...	...	...	X
BREAD, WHOLE WHEAT	X	XXX	...	...	X
MILK, WHOLE	XXX	XX	X	X	XXX
MILK, BUTTER OR SKIMMED	X	XX	X	...	XXX
BUTTER	XXX	...	...	X	...
EGGS	XX	X	...	XX	XX
LIVER, BEEF, PIG	XXX	XX	X	X	XXX
MEAT (Average)	X	XX	...	...	XX
NUTS	X	XXX	...	...	XX
FRUITS, FRESH (Average)	X to XX	X to XX	XX to XXX	...	X to XX
GREEN VEGETABLES, FRESH (Average)	XX to XXX	X to XX	X to XX	...	X to XX
XXX = Excellent Source; XX = Good to Fair Source; X = Present but Poor Source; ... = No Appreciable Amount or Evidence Lacking					

m 2 68



Thresher shark, now being sought for its vitamin-rich liver, is characterized by an offset tail that is as long as its body

made to educate everyone on the importance of well rounded diets, and what these diets are," says Dr. Truesdail. "Such education will take years, yet today America must develop its full efficiency at once. Because of this, many of the aircraft plants and other defense factories are providing vitamin pills for employes to supplement their average diet. But don't take this as a recommendation that you should dose yourself with vitamin pills promiscuously. The best balance is obtained by eating the right foods, including fresh foods, properly prepared. And remember, even at best a dose of concentrated vitamins won't endow a person with superhuman qualities; such supplements merely make up for the vitamin deficiency in ordinary diets."

Vitamin A, the substance that is necessary for normal growth, tooth and bone formation, proper seeing, and resistance to infections, is found in liver, dairy products, green leafy vegetables, and in bright yellow fruits and vegetables. Vitamin B, the absence of which causes beriberi, occurs in meats, whole grains, milk, and in some vegetables. Vitamin C, the lack of which

Lockheed Aircraft worker is kept at peak of efficiency by doses of vitamins supplementing normal diet



From quartz emanate ultraviolet rays creating Vitamin D in body; the disk at center of the lamp generates infrared waves

causes scurvy as well as dental and gum troubles, is contained in rich amounts in citrus fruits and juices. Vitamin D helps the body utilize calcium and phosphorus and is contained in such commodities as butter, eggs, and canned salmon. It is the scarcest of all the known vitamins in natural foods.

It is also the sunshine vitamin, being formed in the body by exposure to sunshine or to ultraviolet radiations. Vitamin E and a number of other vitamins are contained in milk and other usual foods to a degree adequate for most people.

Certain kitchen practices should be fol-

(Continued to page 162)



m 228

Pacific Redue Bld

Pickup "Jaw" Handles Incendiary Bomb Safely

Mr. H. L. McDonald, Los Angeles

Incendiary bombs, sputtering viciously, can be handled in safety with a jawlike scoop combining a shovel, hoe and shield. It consists of two movable metal plates, opened and closed by manipulating a sliding rod to which one plate is attached. The operator crouches at the end of the long handle, where the other plate shields him from the intense heat. To pick up a bomb, the scoop is set down with the two curved plates on either side of the missile, and then it is closed like two jaws. It can be used also for scooping up sand and spreading it over the burning bomb.



Demonstrating with fuses, left, how jaws of pickup device, operated from distance, can grab incendiary bomb and, right, drop it into pail of sand

Self-Propelled Combine Can Be Operated by One Man

Savings in fuel as well as the labor of one man are possible with a self-propelled combine which operates on only one engine, instead of using two as in the case of a tractor-drawn implement. One man can run the new combine. With hand levers in easy reach he can adapt the machine quickly to meet all crop conditions. One lever operates the threshing and cutting

mechanism, a wheel raises or lowers the platform and another lever engages or disengages the entire platform conveyor, cross conveyor canvases and reel drive. Operating on a separate drive, the threshing speed remains constant regardless of the ground speed. A 12-foot swath of grain is cut in front of the unit, and since no tractor leads the way the standing grain on

an opening cut is not tramped down. Both a bagger and tank model are offered, the bagger accommodating either one or two men besides the driver. The tank model is equipped with a 45-bushel tank. A larger size model, which takes a 16-foot cut, is available for big acreage operators.



Combine driven by its own engine can be operated by one man as all controls are placed within easy reach of anyone in the driver's seat

JUNE, 1942

The Massey-Harris Co., Inc. Racine, Wis

U.S. Naval Institute Proceedings, Feb 1942

Human Senses Duplicated by Man-Made Tools



Girls standing back of table indicate by various gestures the function of the respective instruments

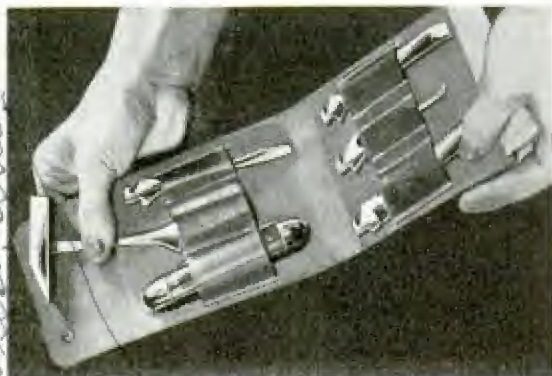
All five physical senses can be reproduced by various types of man-made apparatus which are even more sensitive than the senses bestowed naturally. Five such instruments were demonstrated publicly by engineers of the General Electric company. The electric eye, for instance, can see in the dark, where human eyes are blind. To an electric sound detector, or noise meter, a fly walking over the face of a microphone sounds like soldiers tramp-

ing over the drill grounds. It also picks up the sound of a dollar bill falling on the floor and a cat walking over a rug. Surfaces that feel smooth to the fingers, when tested by a smoothness gauge, become as rough as the rocky mountains. Then there is a mercury detector able to smell the poisonous mercury vapor missed by the nose. Another instrument can taste the smallest drop of lemon juice in a glass of water, a sourness which human taste cannot detect.

Leather Kit Holds Six Tools Handy for Air Raid Warden

Enclosed in a handy pocket kit made of leather, with a snap fastener, are six small tools—sufficient to do many minor repair

jobs. A one-blade knife serves as a handle for the hammer, chisel, awl, screwdriver and a three-inch saw. It is intended particularly for air raid wardens.



Leather folder holds the warden's tools conveniently

Collision of Birds With Airplanes Is Major Flying Hazard

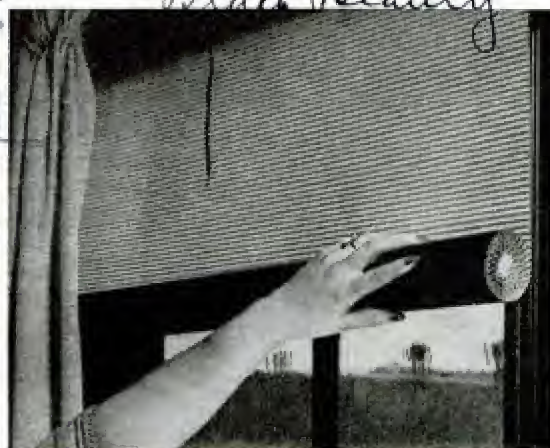
Research to find materials that will protect airplanes against damage by collisions with birds is being advocated by Allen L. Morse, chief of the aircraft development section of Civil Aeronautics Administration. He points out that such accidents have totaled 61 since 1939, two-thirds occurring at night and more than one-third

Science Service
3/10/42

shattering or penetrating the windshield. In one incident a flock of five swans hit a plane at night. One penetrated the leading edge of the left wing, the second almost tore off the left vertical stabilizer, jamming the rudders; the third struck and dented the engine cowl, and two swans went through the propeller. Wild swans weigh as much as 20 pounds. Even small birds have penetrated windshields, and in one instance a bird continued through the bulkhead, traveled the length of the cabin and penetrated the rear wall.

Blackout Window Shade Has Light Face Inside

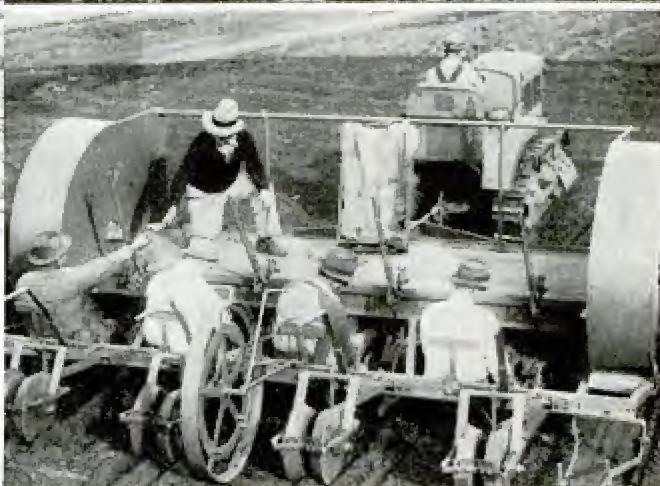
Opaque window shades of semi-rigid material, developed for blackout, have an outward surface of black, while a cheerful ivory finish faces the interior. By a corrugating process the shade is given a one-way rigidity that permits rolling and unrolling and keeps the edges snug against the window frame to prevent light leaks. In its simplest form the shade may be fastened to the window frame by means of adhesive tape. A more convenient installation may be made by fastening one end to the top of the window by means of slats, and rolling the shade upward from the bottom where it is fastened to another slat. When not in use the shade remains tied at the top with a cord.



Blackout shade is rolled up on slat at the bottom

JUNE, 1942

Crop of Rubber Plants Speeded By Labor-Saving Methods



Top, machine travels up and down rows gathering seeds by vacuum. Four men, bottom, set seedlings in holes made by planter

Machines for planting and harvesting the seeds of guayule, a plant which yields rubber, are aiding in the fight to relieve the threatened rubber shortage. One machine gathers by vacuum enough seed from the rows of guayule plants in one acre to plant 10 acres. As seeds are vacuumed, they are stored in a bin at the rear of the machine. Another machine operated by four men prepares holes for transplanting seedlings and covers the plants after they are dropped into the field by the men. Each man can plant 60 seedlings a minute by this process. Once it is started, guayule grows without much help, needing relatively little moisture. In harvesting, the whole plant is taken, finely ground and dumped into tanks of water, where the crude rubber floats and is skimmed off. The pulp can be handled by the same machines that process rubber.

Sakarias Valley
Calif

DOGS of WAR



A dog sentry leaps over hood of a "jeep." In the same way, the dogs go over fences and other barriers

WAR dogs of the United States Army are distinguishing themselves for bravery in the line of duty.

Recently a soldier and his dog companion were walking beat on night patrol against spies and saboteurs. All was well, as far as the sentry knew, but the dog's keen nose detected someone lurking in the brush. At the first growl the soldier challenged the unseen prowler. There was no answer. At once the sentry gave the sharp command

"Get him!" The dog leaped forward with a snarl and an instant later there was the sound of an impact and a cry of pain. The man was captured.

One soldier and a dog are better than two men for guard duty and for extended sentry duty in the field. The four-legged sentry smells and senses danger that the human can't see or hear. There is no chance now for the soldier on night patrol to be attacked by surprise or ambush. His

dog is a "one shot" weapon far better than a rifle in the dark.

At Fort MacArthur near Los Angeles the Army is using dog sentries in an operation that started as an experiment and that has turned out to be a success. Several dozen dogs go out on military duty each night. Some of them guard enclosures by themselves and give the alarm if anyone approaches, while

Training a dog to tow big reel of telephone wire makes him useful in communications work



7m 12 4

others march with regular sentries.

Ordinarily a dog obeys one master best, but at Fort MacArthur the desire has been to produce trained dogs that will work equally well with any soldier. Under the direction of Lieut. Col. Glen Miller, a training course was worked out by Sergeant Robert H. Pearce that teaches the dogs to operate anywhere at any time and under the command of any soldier who is in charge of them. Savage fighters when the need arises, they are easy to control. They are trained to attack anyone who approaches a sentry and yet each permits himself to be handed over quietly to the sentry's relief when the guard is changed. Dogs work with different men each night.

High intelligence and a combative spirit are two of the canine enlistment requirements. And an Army dog must be able to knock a man down. Even a 200-pound man can be knocked sprawling by a dog that weighs only a quarter as much but that has learned to make a tremendous lunge and to hit high.

Most of the canine recruits were household pets in civil life and are friendly with each other at the start. But each becomes extremely jealous of the other dogs as training proceeds. The Army has a waiting list of nearly 1,000 dogs whose owners have volunteered them for the service.

You can teach an old dog new tricks, fortunately, and Sergeant Pearce picks dogs that



Trainer encourages dog to fight "prowler" and to go after the right arm, the one which usually wields a club or other weapon

Carl Spitz adjusting earphones and small radio on dog. The radio enables trainer to give commands when dog is some distance away

see June 1941 72



By having dog jump over the extended arm, the trainer gradually teaches the animal how to leap over high fences and walls

*Major Miller
Lt. Col. Adams*



77129



Dog in training for army work is shown seeking trainer who lurks in bushes with a weapon

have outgrown the playful puppy stage. The training methods that he has developed are simpler than most and result in rapid and thorough training even for dogs that are five or six years old. First on the program are several weeks of standard obedience instruction. Pearce and several other trainers all work with each dog. This helps the dog to understand that he is to obey anyone who takes charge of him.

Next the dogs work out on a stuffed dummy hung several feet off the ground.

such an attack, the dog fights back savagely. This puts him constantly on the alert against surprise.

When a dog graduates from training school Sergeant Pearce stamps his name on a regular identification tag that reads "U. S. Army Dog Sentry" and attaches it to the dog's collar. The dogs work 12 hours a night with one night a week off. They get a meal of raw meat in the morning, sleep most of the day and sun themselves in the afternoons.

Here trainer, clad in old overcoats and protected by hand and arm padding, teaches dog to attack



Held by chain, dog is poised to spring at trainer who is encouraging him to fight



7m 12 9-

Hollywood dog training school, 12350 Revere drive

Similar to the work of the dog sentries at Fort MacArthur but not connected with it are the duties of a group of dogs that are guarding some of the depots of the quartermaster corps on the west coast. These dogs were trained and donated to the corps by Carl Spitz, Hollywood dog trainer. Spitz picks dogs that are about 25 inches in height and that weigh 80 or 90 pounds. He finds that purebreds are easier to train than most crossbreeds. German shepherds, collies, doberman pinschers, malamutes, and other working dogs take the work seriously and make dependable guard dogs. The dogs that he is training for military service are taught to regard with suspicion anyone who doesn't wear a uniform.

The first part of the schooling that Spitz gives his animals, of course, is the regular obedience training by which a dog learns to sit, drop, heel, stay, and come. Jumping over high and wide obstacles, carrying and retrieving objects, and barking on command are other parts of the course. The dogs learn how to search for a suspect who may have concealed himself, how to give an alarm, and how to attack. Part of his system is to teach the dogs to realize their own strength so that they will have the advantage of perfect confidence in a fight.

Most dogs abhor smoke and noise and yet dogs in military service should carry on their duties in spite of such conditions. Accordingly the dogs are walked and rehearsed through clouds of chemical smoke and they are taught to work unperturbed while firecrackers, torpedoes and guns are discharged close by. To be able to control the actions of a dog far in the field, out of sight or hearing, Spitz has experimented with a short-wave radio, the receiving set of which is carried by the dog. Earphones may be used but the best results have been had with a small speaker built into the

(Continued to page 164)



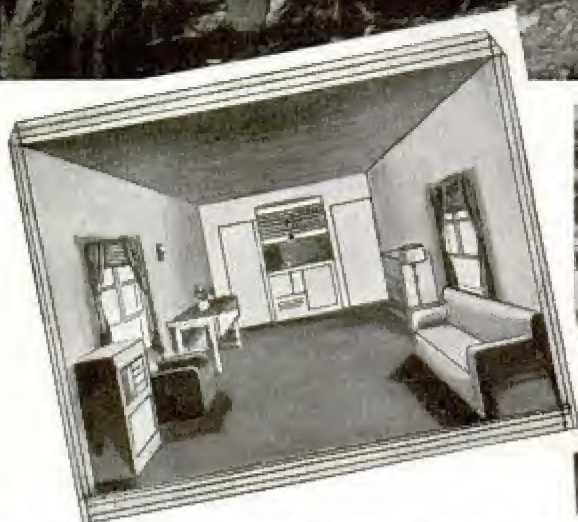
Dog sentry descending from high platform after climbing to the top; this training teaches way to surmount obstacles

Patrolling boundary fence of military post with dog sentry



Nine-Ton Welded Steel Home Is Trucked to Site

Journalist - Apart. Home



At lower right a truck hauls the ready-built house to its site, where a crane lifts it to concrete foundation piers (top). At far end of living room (lower left) is kitchen unit and doors to bedroom and bathroom

Ready-made insulated houses built of welded steel panels, weighing only nine tons equipped, are being trucked from factory to homesites and laid on prepared foundation piers by tractor crane. The 12-gauge sheet steel used in making the houses is too light for most war purposes. The basic "apartment-house" is 11 feet wide and 27 feet, 2 inches long. Inside is a 10½ by 18½ foot living room; at one end of it is a kitchen unit comprising sink, electric refrigerator, electric stove and storage cabinet. On one side of this kitchen unit is a door leading to the bathroom, on the other

side the bedroom, with a built-in roll-away bed. A hot water heater is also included. The kitchen unit, when not in use, is concealed by a venetian blind that can be pulled down to the floor.

Exposure to 63,000-Foot Altitude Would Kill by Boiling

If pressure-cabin airplanes of the future should ever fly as high as 63,000 feet, any failure of the pressure system would cause instant death of its occupants, says Major Harry G. Armstrong, director of the re-

search section, School of Aviation Medicine, at Randolph field, Texas. He explains that boiling point depends on atmospheric pressure as well as on temperature, and at the normal temperature of the body its fluids will boil in the presence of reduced pressures at 63,000 feet. However, this fact does not worry the Air Forces, since oxygen alone will sustain consciousness at 47,000 feet.

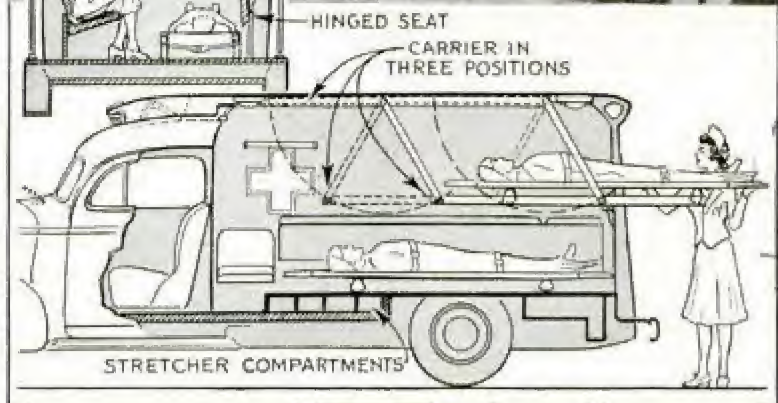
Adjustable Bracket Attaches Outboard Motor to Canoe

Without drilling or piercing the hull with screws or bolts, an outboard motor can be attached to a canoe with an adjustable bracket just brought out. The bar straddles the canoe and is fastened rigidly by two wing nuts that bolt through the gunwale openings. Then the motor is attached in the conventional manner. Both motor and bracket can be removed easily.



Wing nuts attach cross bar through gunwale openings

Four-Place 'Defense Ambulance' Loads and Unloads Easily



Top, removing patient from ambulance; sketches show interior arrangement

Swift evacuation of injured and helpless persons from bombed areas is made possible with a four-stretcher ambulance designed for use in civilian defense work. Besides carrying four patients on standard type stretchers, the ambulance has space for four attendants who can get in and out without crowding the patients. Any of the stretcher patients may be removed or new ones loaded without disturbing the others. Folding bench-type seats at the sides, when erected for use, will carry 12 adults or 20 children comfortably. Interior lighting is provided for runs during blackouts, and a circulating system supplies fresh or heated air. First aid and fire fighting equipment are carried in special compartments.

Seventy-five tons of rubber go into a battleship, and a ton into a medium tank.

Vol. 33 Col. Thomas E. Stinson, Jr.

BLACKING OUT HOLLYWOOD

3842 Franklin Ave. Los Angeles



Hollywood's motion picture studios are a "bright spot" visible from the air for many miles, but they've been organized for quick action if air raids come. Above, electricians are cutting off the power at the Warner Brothers studio during a practice blackout. Air raid shelters have also been prepared in the film colony, and (below) an air raid rehearsal finds actors and technicians filing into the reinforced concrete basement on the Warner lot. A steel-helmeted warden directs them into the sand-bagged entrance. The shelter is stocked with food, water and medical supplies



It might be a good spot for air raid watchers, but the tower at left is an extensible mount for cameras. On some outdoor scenes cameras shoot various angles from the four platforms



The big studios in the movie capital have their own hospitals, which are equipped to take care of casualties in any bombing. First aid corps have also been formed, and (above) a squad of rescuers rushes a "victim" on a stretcher to the first aid headquarters in practice for air-raid work



You'd scarcely consider the film producing studios a military target, but the clustered buildings make an easy target for enemy bombers to find; so Hollywood is not waiting for a raid to prepare. As part of their schooling for war rescue work, a first aid crew (above and at left) straps an "injured" man to a special stretcher and lowers him safely from the roof of a building that was part of a motion picture set



M 252 Distributed thru chain stores.
Bright Plastics Go to Bat for Metal in the Home



Attractive in their own right as well as useful substitutes for metal, plastic utensils of cellulose acetate are bringing a dash of bright color into the home. Or it may be colorless brightness, as in the crystal-clear fruit corer, above, which is unbreakable



Photos from Hercules Powder Co.

Wilmington Del
 Dynamite and photographic film and egg cups bear no particular family resemblance yet they're first cousins. The film in your camera is made of cellulose acetate, and that fruit or cheese knife at the top of this column—cleverly designed to prevent loss of juice in cutting—was molded from powder based on cellulose acetate flake made by Hercules Powder Co., makers also of dynamite and gunpowder. An inexpensive replacement for the stainless-steel knife, the fruit cutter can be had in crystal, pink or blue. Below it is a salad set of "crystal" cellulose acetate; it's nonchipping, and imparts no foreign taste to the food. At the left center are a cluster of "color accents" for the breakfast table—an egg cup in red, or combination of red and white; plastic salt and pepper shakers that are moisture-proof and available in various bright colors. At the bottom are more plastics for the kitchen—measuring cups, funnel, "four-leaf" frame for the clock, knife and measuring spoons, all bright-hued and molded from plastic powder into modern shapes

L 1116 Reggitt 17

SHOOT THEM IN COLOR

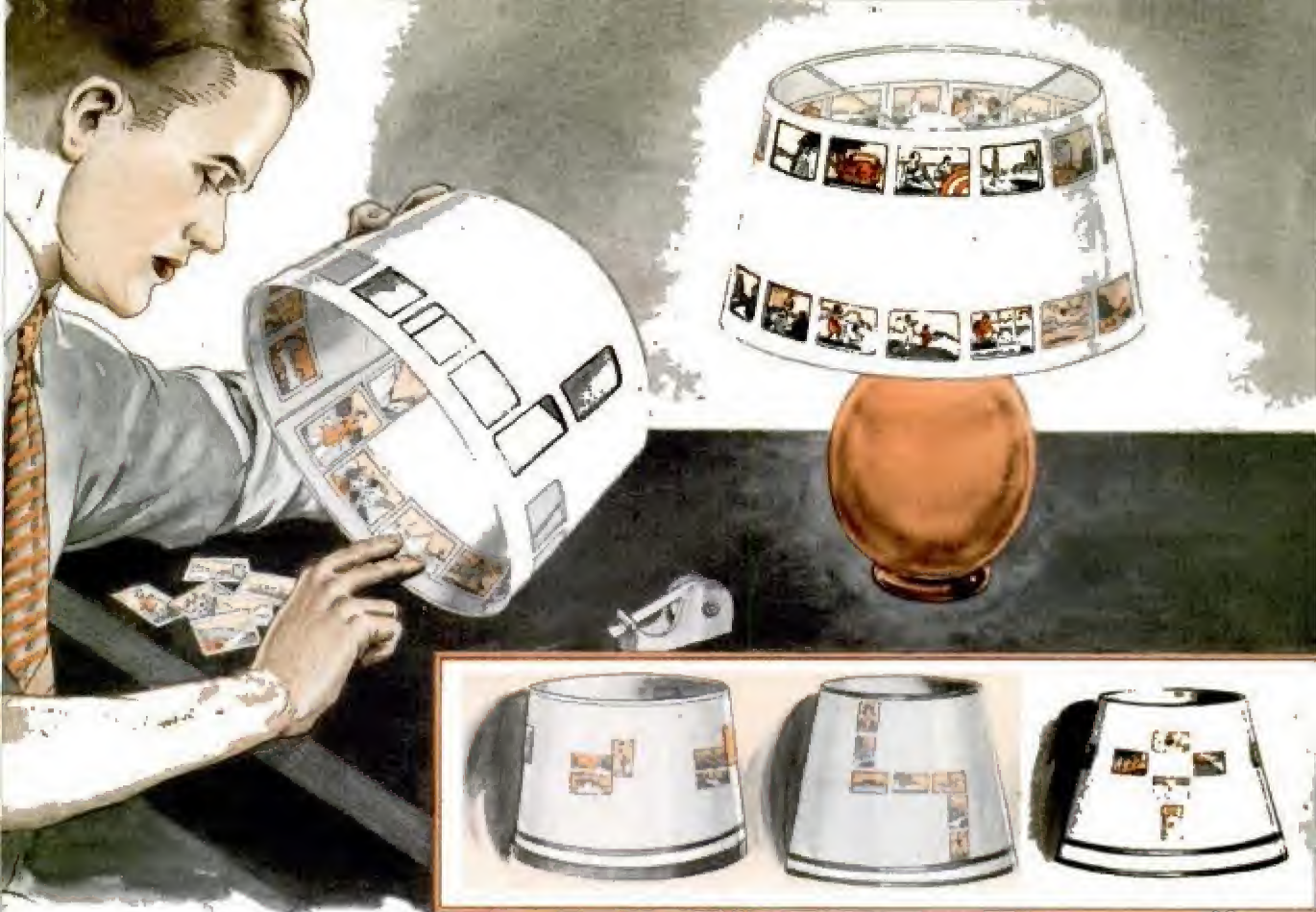


*Eastman Kodak Co
Rochester, N.Y.*

Beautiful Kodachromes can be made indoors by using the film designated for that purpose and by experimenting with lighting

Here's how the above Kodachrome → was made; any amateur can do the same sort of work if his camera is fitted with a proper lens





Among the things that you can do with Kodachromes is decorate lamp shades, particularly the more translucent ones. Note various ways in which the Kodachromes can be applied to shades

TODAY any amateur photographer can take beautiful, full-color shots if he is careful and stays within the limitations of his camera. And he can do it with a camera costing from \$15 to \$35.

Natural hues of outdoor and indoor subjects may be captured on Kodachrome film, which opens up the field of color to the amateur. Upon exposure the film is sent to processing laboratories for conversion into transparencies that may be enjoyed by holding them between the eye and a light source, by projecting them on a screen like the "magic lantern" slides of forty years ago or by looking at them in an inexpensive viewer containing an electric lamp behind translucent glass.

After satisfactory Kodachromes have been made, they may be turned into color prints at reasonable cost. From either 35-millimeter or Bantam size transparencies, in 2 x 2-inch mounts with standard central openings, enlargements may be obtained in two sizes. The smaller enlargement is about 2¼ x 3¼ inches, which comes with rounded corners and minus margins, at a cost of less than one dollar. The larger

is a print 5¾ x 7¾ inches, and is more expensive. Prints may be obtained through any camera supply shop.

To obtain entirely satisfactory results from Kodachrome film, the amateur must be sure his camera is equipped with an anastigmat lens, which has the ability to produce pictures that will be sharp not only at the central part but from edge to edge. Such lenses are free from aberrations, or errors in performance which cause defects in the pictures or distortions of the light rays passing through the lens.

Among the \$15-to-\$35 cameras especially designed for Kodachrome work is one that takes K828 size film, eight exposures to the roll, and is fitted with an f:4.5 anastigmat special lens. Three others, taking K135 size film, are equipped with f:5.6, f:4.5 and f:3.5 anastigmat lenses, respectively, yielding excellent color shots.

No filters or accessories are required for average conditions, because Kodachrome film is made in two types, "Regular" for daylight work and "Type A" for photo-flood lamp exposures. It is necessary that each type be used with the kind of lighting

for which it is intended. Filters are available which enable the amateur to shoot with either type of film and the alternate light source. These filters should be considered, however, as an expedient rather than a regular practice. A colorless haze filter (Wratten No. 1), which absorbs ultraviolet rays, is used with Kodachrome Regular for distant scenes which show bluish haze, for cloudy days and for some snow and water scenes. It prevents excessive bluishness in the color picture.

Good Kodachromes are relatively simple to make, provided care is exercised in several important details. The general precautions necessary in black-and-white photography, such as sharp focus and steady camera, are equally important in color photography. In addition, the amateur should consider accuracy of exposure, proper lighting contrast, variations in the color of sunlight and tungsten light, and color harmony.

For best renditions of col-



This is a miniature camera of the popular 35-mm. type; it has an anastigmat f:3.5 lens and shutter speeds up to 1/200 second

Stereopticon effects can be obtained by using two projectors and viewing picture with Polaroid-lens glasses; without glasses you see double image

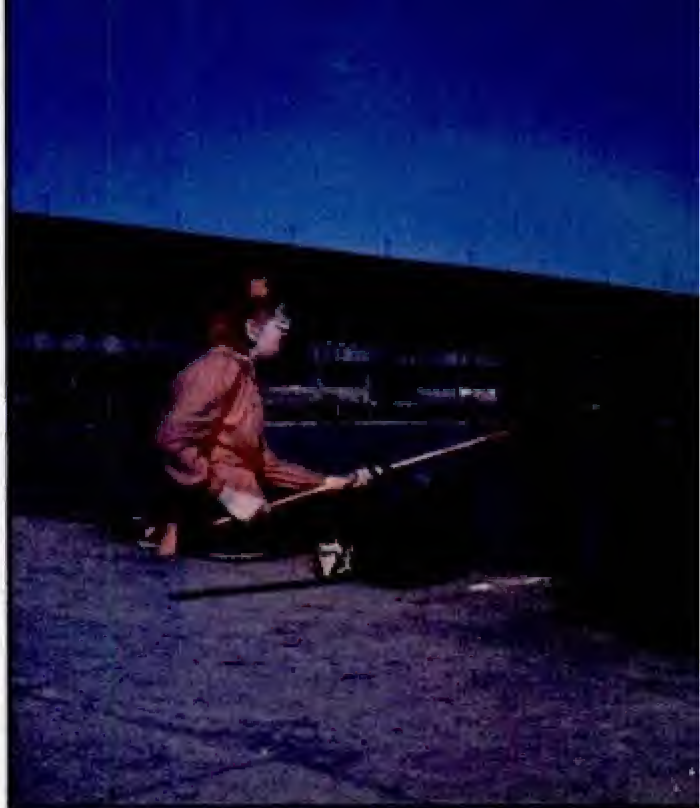




20 This beautiful color shot shows quality obtained by proper handling of the camera

ors on Kodachrome film, exposure must be correct within one-half stop or lens opening. And the type and condition of light, as well as the direction at which it strikes the subject, are important.

In bright, direct sunlight, with the subject facing the light, a basic exposure for an average subject combining both light and dark objects in approximately the



But incorrect exposure time will give you either too light or too dark Kodachromes

same proportions would be $1/50$ of a second with the lens opening between $f:5.6$ and $f:8$. With light-colored subjects—snow and beach scenes, light-hued flowers, subjects with blond complexions and others—move the lens opening to $f:8$. For dark-colored subjects—dark foliage, deep-colored flowers, dark animals, buildings, etc.— $f:5.6$ should be used.

Special consideration must be given to subjects lighted from the side or from the back. For example, an average sidelighted subject, when the sun is bright and direct, requires an exposure of $1/50$ of a second at $f:4.5$, or $1/25$ of a second at $f:6.3$. The same subject backlit—the light coming from behind the subject—would need twice as much exposure, $1/50$ at $f:3.5$, or $1/25$ at $f:4.5$.

Many desirable effects can be obtained when the sun is slightly obscured by a hazy atmosphere. Under these conditions, the basic exposure for an average subject would be $1/50$ at $f:4.5$, or $1/25$ at $f:6.3$. For light-colored subjects, use $1/50$ at $f:5.6$ and for those that are dark, $1/50$ at $f:3.5$ or $1/25$ at $f:5.6$. In open shade on a bright day, the photographer should use $1/50$ at $f:3.5$ or $1/25$ at $f:4.5$ for an average subject, $1/50$ at



← Simple exposure guide is a valuable aid in making good Kodachromes out of doors

21 Lillie

f:4.5 or 1/25 at f:6.3 for light-colored subjects, and 1/25 at f:4.5 for dark-colored subjects. The same exposures stand for shooting when the sky is overcast, cloudy but bright.

In the shade on a bright day, the basic exposure for an average subject should be 1/25 at f:3.5 and with light-colored subjects, a lens opening of f:4.5 should be used. Dark-colored subjects would require 1/10 second at f:4.5, but the camera must be placed on a firm support to prevent movement.

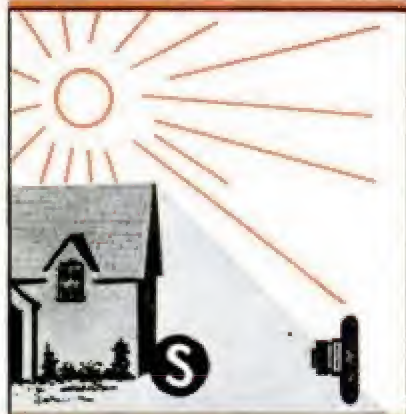
A correctly exposed Kodachrome has all the colors fully represented, and the properly projected picture is neither too light nor too dark, assuming, of course, that the subject was not too contrasty to record properly. An overexposed transparency appears diluted, or too light. A blue sky will be very pale or even white, a red sweater will appear pink and flesh tones will be very pale. An underexposed transparency appears just the reverse, or much too dark.

You can get black-and-white pictures from Kodachromes; note Kodachrome at top and the corresponding black-and-white, bottom, right

This is the exact size of color prints the amateur can get from his Kodachromes at reasonable cost; just consult your camera dealer



22 21116

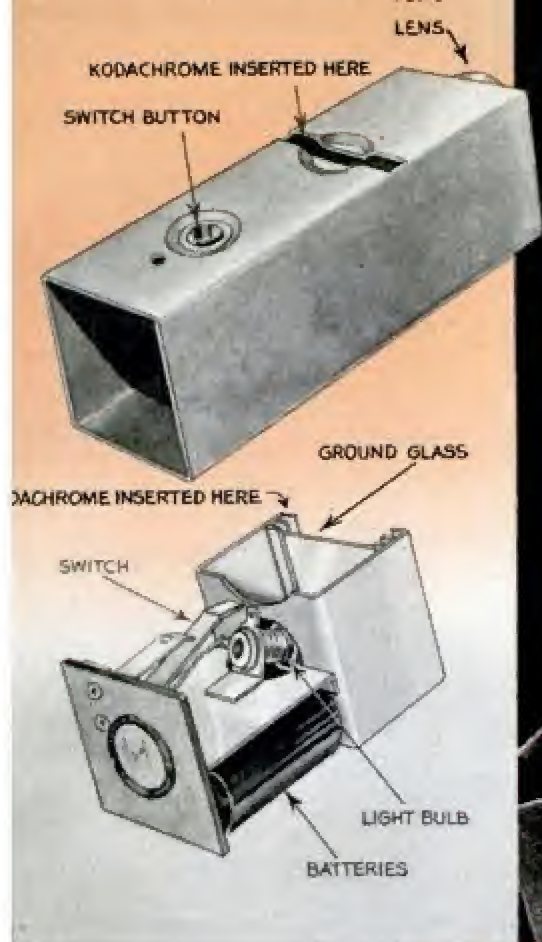


Adapter ring, into which has been inserted a Series V filter, being slipped onto anastigmat special f:3.5 lens on a Kodak 35

Exposure tables supplied with Kodachrome film and the Kodachrome outdoor exposure guide for 35-millimeter and Bantam film deal with pictures in different types of light and offer numerous suggestions for unusual conditions. Occasionally there are unusual subjects to which exposure guides cannot be applied readily. If the picture is important or impossible to retake, it is suggested that several exposures be made: one at the stop representing the best possible estimate, one at the stop below and a third at one stop above.

A Kodachrome transparency having dark areas which are much too dark or light areas which are too light indicates the subject brightness range was too great. It is important, therefore, to photograph the subject in such a manner that an excessive brightness range be reduced or avoided. Outdoors, this generally means care in choosing the camera position. Having the sun behind the photographer's back results in satisfactory lighting, or other positions which give sidelighting or backlighting are also satisfactory if the shadow side of the subject is well illuminated. For closeups of flowers, people and small subjects, a white sheet or large white blotter, placed just outside the view of the lens, will serve as a reflector, illuminating the shadow portions and giving a more even

← Top to bottom, various lighting conditions, with S denoting the subject: bright direct sunlight, bright indirect sunlight, in shade on bright day, cloudy but bright, and weak hazy sun with soft shadows. Camera setting should be watched carefully



23 Right, using the Vuescope, an instrument for viewing Kodachromes. Drawings at left show that this is accomplished by employing a small light bulb drawing current from dry batteries

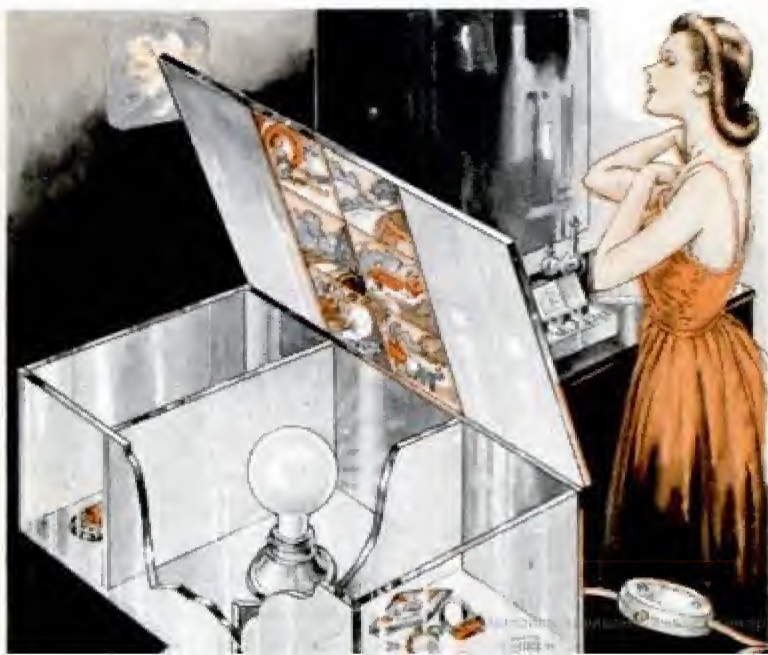
range of brightness over the entire picture.

Kodachrome Regular film is balanced for average daylight sunlight, yet it will render satisfactory results from an hour or two after sunrise until an hour or two before sunset. Near sundown, the direct rays of the sun are much redder than earlier in the day, and much less bright. However, the results are not necessarily displeasing, for sunset pictures, usually showing prominence in the reds, are a fascinating field for the amateur. Considerable variation in color may be noticed in a series of pictures made when the sun is alternately clear and obscured by clouds. Subjects under a gray sky, or misty white sky, are somewhat more bluish than those lighted by direct sunlight, and subjects in the shade, illuminated only by the blue sky, appear very

bluish. For pictures taken on dull days—the sun obscured by clouds—a haze filter slipped over the lens will produce a warmer color rendering.

Kodachrome Type A film can be used without filters with any of the photoflood lamps. Probably the best for general use is the No. 2, which has twice the candle-power and three times the life of the No. 1

Another use that can be made of Kodachromes is in decorating a translucent glass jewel box





This is an example of Kodachrome's effectiveness in taking night shots of such objects as Christmas decorations and illuminated fountains

The possibilities for making good Kodachromes, like this, are virtually unlimited



lamp. Ordinary home lighting lamps should not be used, as their light is more yellowish than that from photofloods and will result in too-yellow transparencies. Any sunlight entering the room, when Kodachrome Type A is being used with floodlights, will result in pictures which are too blue. The remedy is to use Kodachrome Regular film with daylight type photoflood lamps. These lamps also may prove beneficial when a subject illuminated by daylight requires supplementary illumination.

Care must be exercised in the arrangement of color for indoor photographs. Most indoor subjects are people and the lightness and darkness of the background should be close enough to the face so that it will photograph properly, but it should also afford some contrast to the subject. Dark subjects are usually best presented against a lighter background, and light subjects against a darker one; in general, the background color should be of a subdued nature.

Black-and-white pictures must rely to a great extent on contrast and lighting for effectiveness. Kodachrome differs in that very acceptable results may be secured with flat lighting, because a color picture depends upon color contrast for its quality. Informal close-

(Continued to page 176)

Allied Housing Corp., Langhorne, Pa. Knockdown House Can Be Moved and Rebuilt



Four trucks, above, moving dismantled house from one site to another. Right, group of men removing one of the gable ends of the house; bottom, house rebuilt at new site and needing only a few finishing touches

Prefabricated houses which can be set up quickly, and later disassembled, trucked to another site and rebuilt within a single day, are the latest solution offered for defense housing at army camps and in rural areas where munitions plants and other war industries are springing into being. Already the Federal Works Agency has approved purchase of about 10,600 of the portable houses, and plans are made for acquiring more units in the future. The houses are prefabricated of synthetic boards manufactured from old newspapers which are processed chemically and pressed into sturdy boards. In one demonstration a single family dwelling containing two bedrooms was taken apart, hauled 30 miles by truck over country roads and reassembled at the new site, all in less than eight hours.



Phosphorescent Paint Stores Its Own Light and Glows in Blackout

Research men are making an intensive study of phosphorescent materials for blackout lighting. Phosphorescent paint will store up energy while lights are shining, and then glow softly when lights are extinguished, helping workers to find their

way around in a sudden blackout. This stored light will fade out over periods of a few minutes to an hour, but is very helpful at the start of a blackout. Zinc sulfide, calcium sulfide and strontium sulfide are effective phosphorescent materials.

Lightweight Lifesaving Suit Carries Food for Weeks



Easy to slip into, suit floats wearer comfortably

Convenience in handling and better protection are claimed for a rubberized life-saving suit invented by a veteran of World War I, Capt. S. Kronhaus of Los Angeles, Calif. It costs less than the old-style cork preserver, weighs only ten pounds, can be folded into a space smaller than a lady's overnight bag, and can be put on in less than two minutes. It is said to permit ease in maneuvering and keeps the occupant warm and comfortable. A special pocket can carry enough concentrated food tablets to sustain a person for weeks if necessary.

Reciprocating Electric File Saves Time on Jobs



Time required for filing can be reduced to one-half with an electric file now in production. Having a reciprocating

motion excellent for filing, the file is suitable for speed cleaning of small die cast-

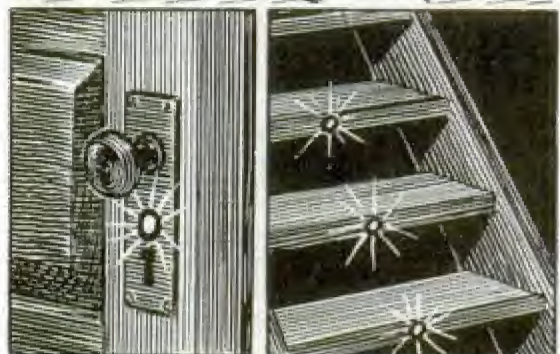
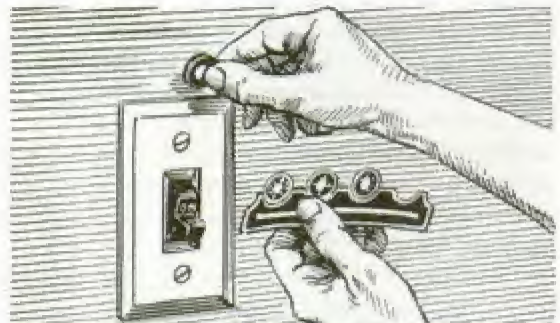
ings and for general operations in tool and pattern shops. The motor, operating on either 110 or 220 volts, has a load speed of 1,500 revolutions. With file attached, the tool weighs four pounds.

Carbon Dioxide by the Carload Would Smother Hangar Fire

Gasoline and oil fires in aircraft hangars would be smothered by a veritable flood of carbon dioxide gas under a plan patented by an Illinois inventor. Liquid carbon dioxide, which becomes gas upon release from pressure cylinders, is effective against oil fires by cutting off the oxygen supply and reducing the temperature below ignition point. However, it has not been available in quantities sufficient to fight a large hangar fire. The inventor proposes storing the liquid under pressure in containers as big as railway tank cars, situated outside the hangar, with pipes leading to strategic points inside the hangar.

Stick-On Luminous Disks Help Locate Objects in Dark

Small luminous disks, plainly visible in the dark, aid in locating objects such as flashlights and door knobs during blackouts. Barely a quarter of an inch in diameter, they are gummed at the back so they



Sketches show methods of using the luminous disks

will adhere to almost anything. The disks serve as guides in the dark when placed along cellar stair edges, walls or in doorways, and they can save fumbling for fuse boxes, light switches and auto ignition switches. They are said to glow permanently in the dark without exposure to light sources.

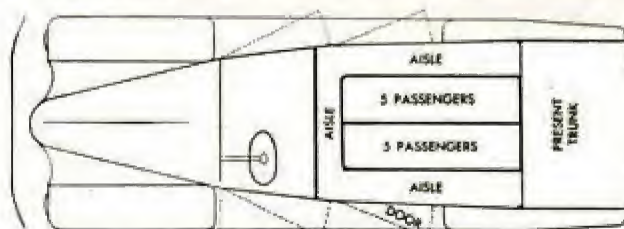
Special Equipment to Save Submarine Victims

Merchant seamen are given a better chance for their lives with new lifesaving apparatus and improvements. Every week the British ministry of war transport tests the latest devices to be offered. At present there are fire-proof hoods for crews of tankers and special suits for protection against exposure that are fitted with electric lights so the wearer can be spotted at night. A completely equipped motor lifeboat includes such things as automatic radio, fire fighting apparatus, signal torch, repair kit and smoke flares. For human needs the boats contain fresh water tanks, vitamin rations, a triple food tank with separated milk tablets, chocolate and pemmican; massage oil, first aid kit and drinking cups.



Some of the lifeboat's equipment is fastened by heavy cords

Sedan Rebuilt Into Ten-Seat Bus To Carry War Workers



Seats facing the sides have been installed in this old seven-passenger sedan, nearly doubling its capacity, as floor plan shows

Conversion of old seven-passenger sedans into ten-seat buses for the transportation of workers to war factories is recommended by the Chicago Motor Club, whose plans for the rebuilding have been endorsed by rationing administrators of Illinois and Indiana. To demonstrate its idea, the club has bought a 1930 seven-passenger sedan for \$200 and raised its seating capacity by installing lengthwise seats in the rear section at a cost of \$47.16, broken down as follows: wood labor, five hours at \$1.00—\$5.00; trim labor, 17 hours, \$17.00; trim material, \$15.25; wood material, \$9.91. Officials estimated that in Illinois and Indiana alone there are 70,000 old seven-passenger family automobiles available for conversion, and the state rationing administrators said they would be eligible for new tires if rebuilt and used for transporting defense workers.

Los Angeles Astronomical Society
2606 W. 8th St.
Los Angeles 50

Enter Damage & Stinson Jr
3872 Franklin Ave



Inspecting the barrel of a small Schmidt telescope camera mounted on larger telescope at Griffith Observatory, Los Angeles

Secrets of the STARS Revealed by MIDGET "EYE"

LOCKED up in a simple picture of some stars is a tool that promises to answer many of the questions that civilization has been asking about the universe.

The extraordinary photograph gives astronomers the hope that they will be able to do as much research in the next twenty years as they had expected to accomplish in the next several centuries.

What is this remarkable picture? A collision of two stars? A comet headed for the earth? Nothing so spectacular. It is merely a sharp, clear picture of a large patch of sky.

There is nothing in it to excite the average person, yet no one has been able to take such a photograph before. It was made with a new kind of telescope camera invented hardly ten years ago.

What gives the new telescope and the pictures it takes such importance is the fact that a good deal of astronomical study is concerned with the relationship of one star with its apparent neighbors. Wide angle pictures that show lots of background permit comparisons and studies of relative star intensities.

Ideal as they are for some important

This Planetarium instrument is used to study star motions



POPULAR MECHANICS

Национальный астрономический музей

Various eyepieces for large refracting telescope are used for different types of observations

The fact is, all large reflecting telescopes are so powerful that they can almost, as far as the average person is concerned, reach out to infinity.

The new kind of telescope, invented by Bernard Schmidt in Germany before the Nazi regime, uses a simple spherical reflecting surface and eliminates all spherical aberration with a correcting lens that disperses the incoming light equally over the curved mirror surface. The light reflected



from the mirror is then absorbed by a photographic film that is curved to the same radius as the mirror surface, producing a negative that is sharp and clear at all points.

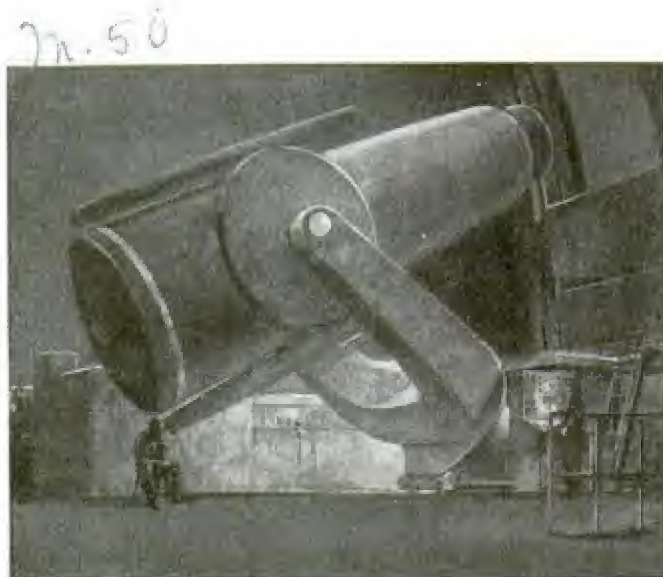
Pictures made with an 18-inch Schmidt at Palomar cover an area in the sky 6,000 times as large as will be possible with the 200-inch telescope. A larger Schmidt with a spherical mirror four feet across is under construction at the same observatory and will bring out much fainter stars than does the present 18-inch instrument.

Originally it was planned at Palomar to use the Schmidts as reconnaissance telescopes for sweeping the sky for interesting objects at which the 200-inch "big eye" could then be pointed. But their wide fields of view make them ideal for other kinds of work as well. They are relatively simple and inexpensive and are comparatively insensitive to temperature changes. They focus all wavelengths of light on the same film surface. Even small Schmidts, because they take such clear pictures, can perform work that previously had required telescopes of far more power.

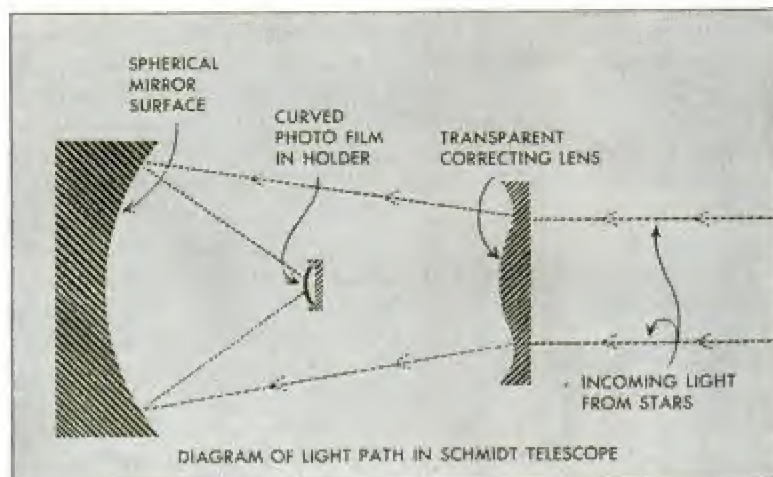
As cameras they are of the high speed type. Exposures require up to a maximum of 20 minutes, so it is possible to take upwards of a dozen photographs per night against an average of two exposures per night with the 100-inch telescope at Mount Wilson.

Looking down into open tube of 200-inch telescope; black chamber at center is room where astronomer will work while photographing star light reflected up through central hole from mirror far below





Drawing shows 48-inch Schmidt telescope being built at Palomar



The diagram above indicates light path in a Schmidt telescope

Below, 18-inch Schmidt "reconnaissance" telescope at Palomar



These characteristics mean several things. The Schmidt is ideal for studying regular and irregular variable stars, novae, and comets. Its speed plus its wide angle gives astronomers a patrol instrument that can map the whole visible sky in a few nights. Now they will be able to keep track of 100 times the possibly 100,000,000 stars that they systematically observe. More information on the distribution of stars in the Milky Way, the galaxy of which our sun is a member, will be gathered by the large Schmidts. Such study may clear up the puzzle as to whether the Milky Way has a spiral structure like some of the great nebulae.

Until now, progress in astronomy has been limited by the small number of telescopes available for supplying astronomers with information. Development of the Schmidt reverses the bottleneck and from now on the speed of research or accomplishments will depend more on the number of astronomers who are available for interpreting the data that the Schmidts provide.

To date the stars visible in the southern hemisphere have received little attention. Most of the world's large telescopes are north of the equator. But since small Schmidts cost only a fraction of the price of a large telescope and can do hundreds of times more general work, it now will be easy to map thoroughly the southern stars. Some astronomers believe that aside from one more giant telescope of conventional design that is needed for the southern hemisphere, all the important astronomical telescopes of the future will be of the Schmidt type.

The inventor of the Schmidt was an amateur rather than a professional astronomer, and development of the new telescope in the United States has been carried on

largely by amateurs. Amateurs probably have built and are using more Schmidts than the professionals, though many professional instruments are now under construction. A Chicago amateur group built a Schmidt for a Yerkes eclipse expedition several years ago, and the Los Angeles Astronomical Society is finishing a 12-inch Schmidt at present.

Amateur telescope-making groups are now planning to make terrestrial instruments for the armed forces. Many young men who took up star gazing as a hobby have learned that their understanding of celestial bodies has especially fitted them for training to become navigation officers on large bombers. The Schmidt telescope itself is contributing to our war effort, since an adaptation of the principle has produced a keen-eyed aerial camera now in mass production.

At the same time that the Schmidt has been in development, our bigger telescopes in effect have been growing in size. Recent advances in optics and photography have increased the efficiency of the 100-inch telescope to the "speed" expected of the 200-inch telescope when the latter was planned in 1928. When the Palomar instrument is put to work it will have the light-gathering capacity of at least a 400-inch instrument of earlier design.

One of the most important improvements has been in the speeding up of red-sensitive photo films, permitting shorter exposures. Red light is least affected by the clouds of cosmic dust that exist in space, hence films sensitive to red light can pick up stars not recorded on ordinary or blue-sensitive film. Another factor that has speeded up the telescope is the elimination of stray reflections by treating lens surfaces with nonreflecting films of lithium and calcium fluorides.

at Lick Observatory



Installing camera box at focus of large refracting telescope



View of unfinished 200-inch telescope at Palomar observatory

Some of the special grinding tools used in shaping a 12-inch Schmidt reflecting mirror; mirror glass rests on white slab



Air-Operated Siren Gives Air Raid Warnings



463 West St. New York
Compressed air is used in a siren developed at the Bell Telephone laboratories to give it a powerful wail. Placed on the Manhattan bridge in New York City to test its ability as an air raid siren, it sent out a shriek that was heard as far away as the Battery.

Air raid siren tested on Manhattan bridge, pierced the din of busy New York City with a powerful shriek that was heard as far away as the Battery

Helium Cloud Saves Magnesium From Catching Fire While Welding

M 296
Welding of inflammable metals such as magnesium can be accomplished under a patent granted Russell Meredith of Los Angeles, Calif. The invention involves the application of helium, a noninflammable gas, to the welding area, and is used in a new welding torch developed by Northrop Aircraft, Inc. Due to its extreme lightness, magnesium is being used widely in the

construction of airplanes, and when applied in thin sheets it was necessary to fasten it by the slower riveting process, because the welding arc or flame would ignite the metal. To produce the protective blanket of helium the electric arc welder has a hollow handle and nozzle from which the gas is emitted to surround the point at which the magnesium is being welded.

Unexploded Bombs Hauled in Cart Made of Heavy Cable

M 250 Hawthorne, Calif.
Bombs that fall in a city and fail to explode present a constant danger until they have been removed and destroyed. The latest carrier for their removal is a trailer developed by the New York Department of Public Works. Its body is a heavy cable affair housing a smaller cage of similar construction in which the bombs may be conveyed to isolated areas.



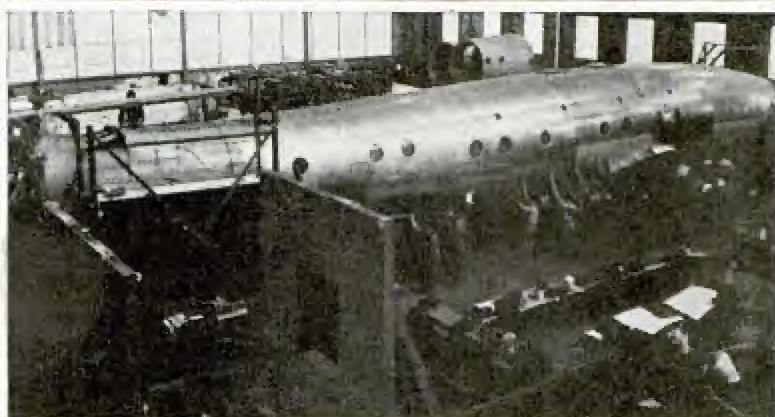
Trailer with structure resembling an inverted basket will haul unexploded bombs from the city to remote places where they may be destroyed

m200 Const. Thomas E. Sherson, Jr.
Giant Air Transport to Carry 57 Passengers

Ready for test-flights this summer, a 57-passenger commercial plane designed for peacetime use will be capable of spanning the United States from Los Angeles to New York in 8½ hours. It is under construction for Transcontinental and Western Air lines at the Lockheed Aircraft Corporation's plant in Burbank, Calif. Powered by four 2,500-horsepower engines, the Constellation, as it is known, will have a range of 4,000 miles and will fly above altitudes of 25,000 feet at a cruising speed of 285 miles an hour and a top speed of 350. The \$500,000 transport will be handled by a crew of seven.



Top, wind tunnel model of coast-to-coast airplane. Fuselage, bottom, gives an idea of its enormous proportions

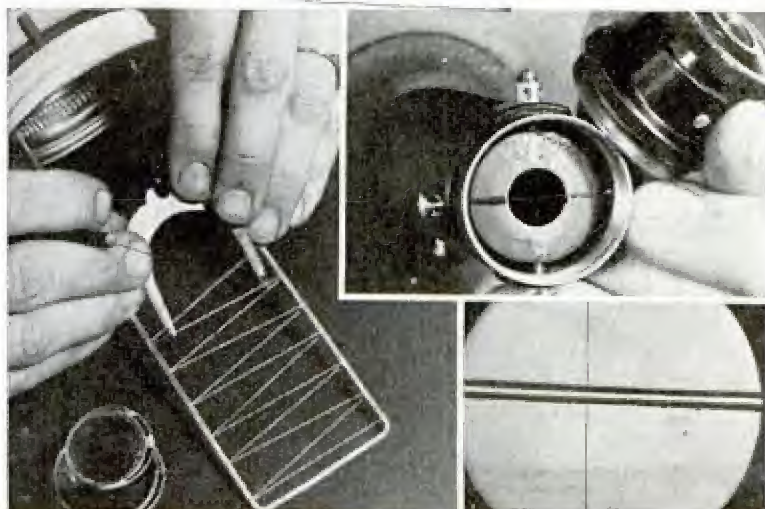


m203
Special Tools Install Spider Webs in Optical Instruments

Mounting spider webs as cross-hairs in precision optical instruments is the delicate task performed by Henri Hoffman at Ohio State University's engineering ex-

slated engineer
 perimental station. To attain the high degree of accuracy needed, he devised a mounting machine. The web is handled with a small fork. Hoffman gathers and

preserves the webs for later use, and often a web must be untwisted carefully in order to obtain uniform thickness of the cross-hair. Webs are so thin it would require about 10 to equal the thickness of the page on which this is printed. Although in the latest instruments the mounted web is replaced by fine lines etched in a glass disk, there are thousands of older type instruments in use which require occasional replacement of broken cross-hairs.



Left, using fork to pick up spider web from frame. Right, top, eyepiece with web in place; bottom, human hair (horizontal) compared with a web

The COAST

November 2, a month before actual war, President Roosevelt put the entire Coast Guard under Navy jurisdiction; but even before that Coast Guard ships and planes had been on "active" service. It was the Coast Guard Cutter "Bear," that reconditioned veteran that had served Admiral Byrd in the Antarctic, that apprehended off Greenland a Norwegian vessel that was acting as offshore base for a German radio station.

Although smaller than the Army or Navy in man power and equipment, the Coast Guard is the sentinel of the American coast-

← Coast Guard Academy graduates will quadruple by '45. At left, signal practice on training ship

Manning America's 500 light-houses is one responsibility of the Guardsmen in peace and war
↓

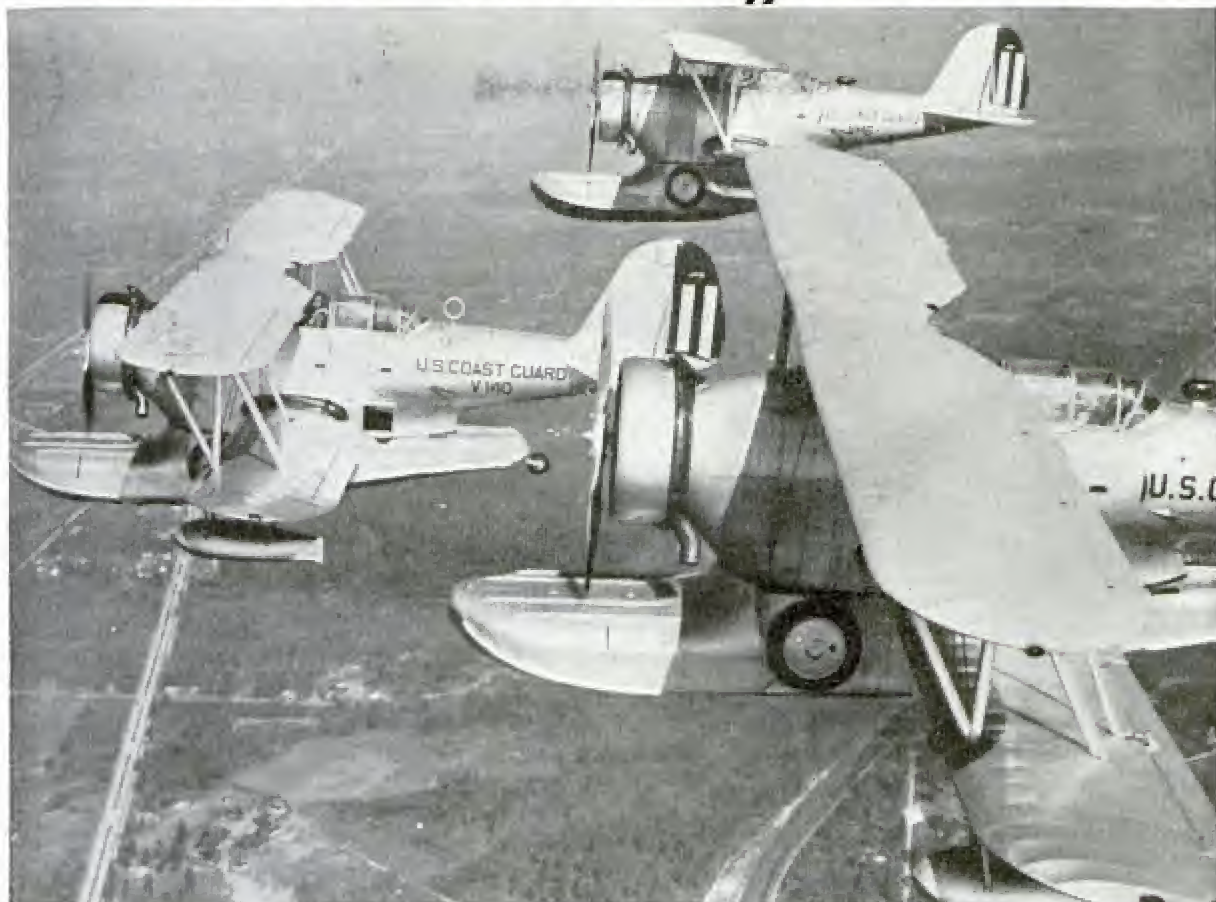
THEY'RE lifesavers in peace, but the Coast Guard has never missed a fight. They're in the Navy now, as they were in other wars.

Back in 1812 they stood with the young American Navy against the British. They wrote exciting chapters in the Seminole uprisings of 1836, the Mexican War of '48 and the Spanish-American war in '98. In the first world war they performed valiant and dangerous service, maintaining the shore defenses of the United States, helping track and destroy submarines, conveying ships between Gibraltar and England. The percentage of men lost was the highest of any branch of Uncle Sam's forces, including even the army.

The Coast Guard began polishing up its famous motto, "Semper Paratus"—always ready—as long ago as 1934, when Hitler made his first open aggressive move by marching troops into the Rhineland. Last



GUARD GIRDS *for* BATTLE



These Grumman amphibians are part of the Coast Guard's fleet spotting submarines and rescuing their victims

line, the United States' seagoing police. Since its founding in 1790 under George Washington, the Coast Guard has performed a wide variety of duties. These have included the prevention of smuggling of liquor, narcotics and other contraband; patrol of the waters of the North Atlantic and the North Pacific; enforcement of navigation laws; protection of fur-bearing animals, birds and fishing grounds; supervision of the anchorage and movement of vessels handling dangerous cargoes; winter patrol of the ocean to help people or vessels in distress; removal of derelicts and other obstructions to navigation; maintenance of a system of marine aids to navigation including lighthouses, lightships, radio beacons and buoys.

So essential to the welfare of the nation has the Coast Guard be-

Repairing the lens of one of 20,000 buoys guarding our coasts



U. S. Coast Guard photos



Wreckers from a cutter prepare to destroy a derelict menacing shipping

rum or remove sick persons from ships at sea, it was patrolling the ocean long before the Neutrality Patrol came into being. The Coast Guard likes to remember that one of its own officers, Commander E. F. Stone was co-pilot of the first flying boat to cross the Atlantic, the NC-4.

With America's shipbuilding yards humming night and day, and dozens of military and merchant craft sliding down the ways each month, the Coast Guard's duties of keeping harbors, coastlines and rivers safe for

shipping take on a vast military importance. In 1939 the control of 30,000 navigational aids in America's rivers and harbors was transferred from the department of Commerce to the Coast Guard. In the last twelve months these have been increased by more than 1,000.

War has brought many new duties to the Coast Guard which it must carry on in addition to its peace-time chores.

The Coast Guard's hundreds of sea-going cutters have been converted for war duties under specifications provided by the Navy Department. The conversion work includes the installation of additional guns, enlargement of magazines, fitting of depth-charge racks and the installation of ordnance and underwater sound detection apparatus.

In addition to readying-up its present equipment, the Coast Guard has been authorized to obtain new ships—just how many is a military secret. Shipbuilding ways and a \$500,000 dry dock are being built to provide new cutters for the Coast Guard.

Since aviation has come to be an essential part of the Coast Guard, it was only natural that "the Service" should be called to help the Navy in patrolling the blue waters, spotting from the air and reporting the presence of enemy submarines and raiders.

The Coast Guard is especially proud of its record in the air. In addition to many dramatic and spectacular flights to deliver se-

shipping take on a vast military importance.

In 1939 the control of 30,000 navigational aids in America's rivers and harbors was transferred from the department of Commerce to the Coast Guard. In the last twelve months these have been increased by more than 1,000.

Navigational aids include some 500 fully attended lighthouses on the Atlantic and Pacific coasts, Puerto Rico, Alaska and Hawaii; several thousands of other helps to safe shipping; 31 lightships on both coasts; 20,000 buoys in navigable waters. All this has meant additional work for

Coast Guard ice breakers keep harbors, lakes and rivers open





Coast Guard cadets are trained as thoroughly as midshipmen at Annapolis. Here they learn marine surveying

the stout-hearted men of the Coast Guard.

President Roosevelt's proclamation of June 27, 1940, gave the Coast Guard the job of supervising the unloading of explosives and other dangerous cargoes in American ports—as well as the anchorage and movement of all such vessels.

The Coast Guard's long experience in maintaining the International Ice Patrol in the Atlantic and the Bering Sea Patrol in the North Pacific waters around Alaska is now increasingly important with both these areas essential to the sea defenses of the United States.

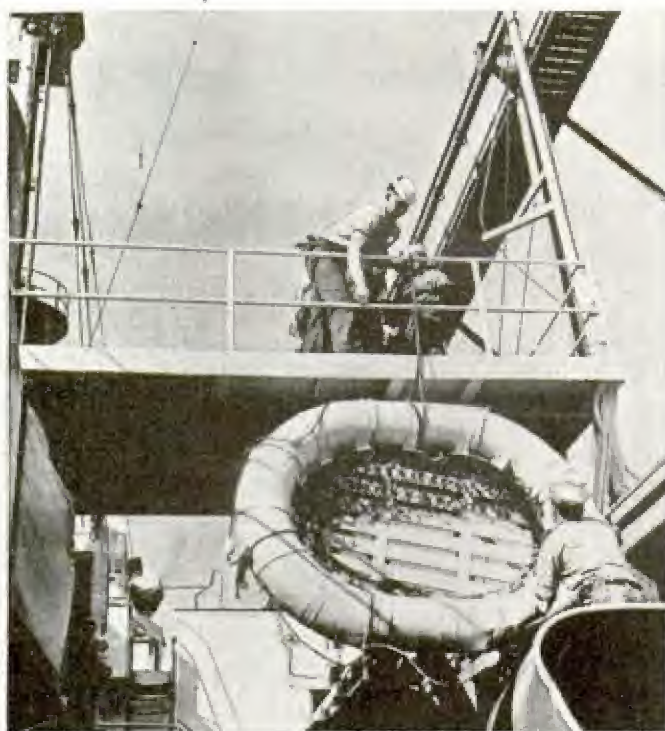
Coast Guard Cutters have acted as stations in the mid-Atlantic serving as weather observation posts. Weather observations in mid-Atlantic are particularly important at the present time—if Clipper plane crossings of the Atlantic are to be continued. The war has halted nearly all of the voluntary meteorological reporting which used to be performed by commercial vessels and upon which the U. S. Weather Bureau relied. Information from Europe, too, has been seriously curtailed.

Weather reports ordinarily are flashed to the U. S. Weather Bureau from the mid-Atlantic

Coast Guard cutters at 6-hour intervals, day and night. This information is based upon observations made every three hours, upon pilot balloon observations of the upper air made every six hours and upon other observations taken hourly. In peace time, radiosonde observations were taken each morning at 3 a.m. in the upper air at heights of 50,000 feet. The radiosonde, a miniature radio broadcasting station weighing less than 2 pounds, is sent aloft attached to a carrier balloon. Observations of the temperature, air pressure and humidity are broadcast continuously by the radiosonde device and received aboard the cutter by a special radio receiver.

Nine-lens camera for flying boat will cover 300 square miles at 20,000 feet





Extra life rafts are being stored aboard all Coast Guard ships

The Coast Guard's long experience in ice-breaking activities has already proved to be valuable in the national defense program. Last spring the Coast Guard opened the Sault Ste. Marie locks on the Great Lakes on April 13—the earliest navigation through the locks in 40 years. This record-breaking opening of ice-choked channels after a severe winter made possible the passage of ships from ore ports on Lake Superior to lower lake ports such as Chicago, Detroit and Cleveland.

or in fog. They have a maximum range of up to 200 miles.

A simple dot and dash signal, broadcast on a definite time schedule, serves to identify the sending station. Then by means of a radio direction finder the listening ship determines the direction from which the signal comes. As radio beacons are audible far beyond the visibility of the most powerful lights, a comparatively small number of stations can effectively mark the navigable waters of the United States.

An injured man brought ashore by rescue plane is removed to a hospital



Last year, for the first time, the Coast Guard sent one of its Grumman JRF-3 planes and a communications truck to the Great Lakes area. Each day reconnaissance flights were made to obtain information on the position, movement and thickness of the ice. This information, co-ordinated with reports from shore stations, proved valuable in sending ice-breaking ships to the proper places at the proper time.

The Coast Guard played an important role in putting into practical use the marine radio beacon—said to be the most important development in lighthouse engineering in recent years.

Radio beacon signals were broadcast from 144 lightships and lighthouses along the Pacific, the Atlantic and the Great Lakes. They are especially valuable to navigation because they are audible night or day, in clear weather

To carry on its war-time duties, in addition to its many regular jobs of peace time, the Coast Guard is increasing its personnel.

The Coast Guard Reserve, set up by Congress on February 19, 1941, created a reserve force of several hundred officers and enlisted men—all of whom are now on active duty. This organization is comparable to the United States Naval Reserve whose officers and men are called to active duty during a national emergency and who return to

21245

M 216

"Plug-in" Electric Belt Conveyor Saves Factory Elevator

A black and white photograph of a man in a workshop, leaning over a large, curved metal component, possibly a part of a machine or a mold, with a large window in the background.

The Platts Standard & Paper
535 Bond Court Island Creek

2019 4
Rolling T

10

am.
~~no answer~~

JUNE, 1942

on may be adjusted to suit the fisherman.

Pachner & Kollerchen 39
2310 W. 69th

21314

"FLYING MULES" of the ARMY



Men and equipment being loaded into an army transport—one of the "flying mules"

ONE of the biggest, busiest and most rapidly expanding airlines in the country is the 50th Transport Wing, which is a freight and passenger-carrying section of the U. S. Army Air Forces.

Daily its big two-motored Douglas planes shuttle back and forth across the country or fly over mountains, jungle and blue water to reach such outlying bases as Newfoundland, Puerto Rico, the Panama Canal and Alaska. The line flies as much freight as 19 other major airlines and it stands fifth in the number of passengers carried. Its

planes have taken off on schedule for the past six years in storm, snow and fog, but it has never lost the life of a passenger or pilot through accident.

In other wars the U. S. Army has been content to rely on plodding mules, slow freight trains or lumbering trucks. But in this age of mechanized speed it has turned to air transportation—which is about four times as swift as rail transportation.

One of the 50th Transport Wing's major jobs in the past three years has been to fly airplane parts and supplies from manufac-

turers to assembly factories working on government contracts. The Army wants planes in a hurry, and it's willing to do its share to help "get 'em into the blue."

Likewise, the 50th Transport Wing carries propellers, motors, gas tanks, wing sections, landing gear and other necessary spare parts to outlying Army bases. As war needs demand, its



Freight loaded into army transport; 50th Transport Wing carries as much freight as 19 other major airlines in U. S.

Cont. O. J. Macmillan, Inc. 11977, '14 S
 Westmoreland
 California
 Los Angeles



Model planes are used in teaching Air Corps students certain flight maneuvers

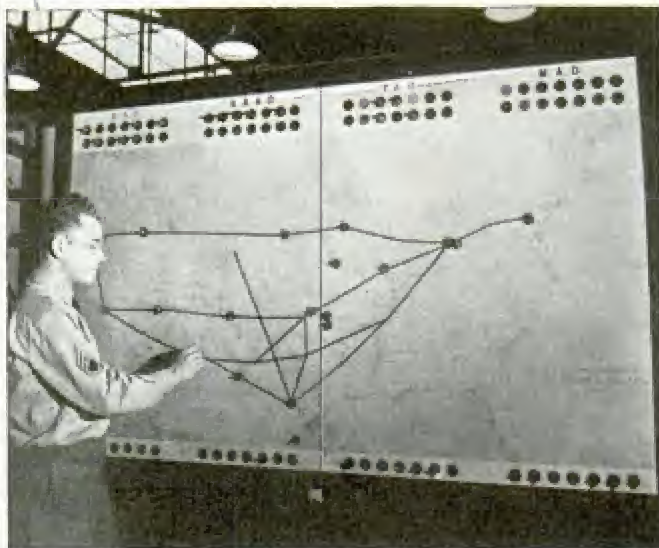
cargo may be machine guns, light artillery, ammunition, blitz buggies or motorcycles. Army officers, engineers and civilian advisors ride the Army air line from coast to coast. Many precious days spent in transit are thus saved. Another of its jobs is to carry parachute troops.

Organized in 1935, the U. S. Army transport organization consisted then of four squadrons—each equipped with two C-27 Bellanca Airbuses. In 1936 the squadrons were augmented by two Douglas DC-2's per squadron. In 1938 speeds and payloads

were again boosted with the addition of 24 Douglas DC-3's. In that year, too, the service was extended to include regular interdepot flights and subsequent coast to coast flights.

At present the 50th Transport Wing has a large number of transport planes basically similar to the Douglas DC-3's which fly commercial airlines throughout America. The number is increasing and when a new Douglas plant gets into full operation hundreds of new C-47's will be added.

Commercial planes are like huge, silvery



Routing board shows position of all planes at all times to officers in charge of 50th Transport Wing's operations



Rolled in felt pads, some kinds of supplies, including guns and ammunition can be parachuted safely to the ground

Special armed units—the parachute troopers and air-borne infantry—are moved rapidly by means of army transports



birds, but the Army's "flying mules" are drab and colorless with camouflage. Inside, though structurally similar to the passenger planes, the Army transports lack soundproofing, deep upholstering, and interior decorations which have made American commercial planes the last word in luxury. The transports, bare and utilitarian, are built for work. The floors and sides of the cabins are sturdily reinforced with heavy sheet metal to support the heaviest of loads. Special fittings make it possible to bolt and lash down cargo. More than 7,000 pounds of freight can be carried in a single plane. Each plane is equipped with its own portable crane and hoist so that loading and unloading can be done by the crew's members, if necessary, without ground equipment. Doors are extra large so that cargo can be loaded and unloaded quickly. When propellers are carried, they are lashed to the underside of the wings instead of being stored inside the plane.

Wright Field, Dayton, Ohio, is headquarters and "nerve center" for the 50th Transport Wing. Here, flight schedules are made up and teletype communication is maintained with the other Army depots throughout the continental United States. When a plane sets out on a flight, it is spotted on the routing board and its movements are followed through the entire flight. This enables headquarters to keep a close check on all planes at all times.

A regular schedule of flights is maintained from Wright Field to Fairfield Air Depot, Fairfield, Ohio; Middletown Air Depot at Middletown, Penn.; Sacramento Air Depot at Sacramento, Calif.; San Antonio Air Depot at San Antonio, Tex.; Ogden Air Depot at Ogden, Utah; and Mobile Air Depot, Mobile, Ala.

Under construction are several more large supply and regular depots, each of which will be served by regular freight schedules of the 50th Transport Wing.

L1314

7m 20 9

For some time there have been regular, 2,116-mile flights from San Antonio to air depots in the Canal Zone. Flights from Sacramento to Alaska and trips to Newfoundland and Puerto Rico also are made.

The 50th Transport Wing takes its pilots from the young men who have won their wings at Kelly Field, the Army's advanced flying school in Texas. It picks men whom it thinks will make the best "big ship" pilots—steady, cool-nerved men instead of the impulsive, daring chaps who will make better fighter pilots.

Precise information on the activities of the 50th Transport Wing is a military secret, but figures for 1940 indicate the bustling growth of this airline. Some 13,311,000 pounds of cargo were moved, some 5,800 passengers carried, a total of 2,615,573 miles flown, 5,019,691 ton-miles flown and 2,377,933 passenger-miles flown—representing 100 to 200 percent increase over 1939. And 1941's figures probably would show a similar increase over 1940.

Let's picture a typical flight.

A drab-colored two-motored transport has just been overhauled at the Middletown, Penn., depot. The teletype chatters out this message from Wright Field:

"Proceed to Fairfield depot. Pick up motors, propellers and gas tanks for San Antonio."

The Army-trained pilots get into their flying gear and the transport trundles down the field and slips into the air. After about two hours of flying the big ship reaches the Fairfield depot.

As soon as it lands trained crews start loading. Engines on mobile shipping cradles are whisked out of the hangars and hoisted into the plane, propellers are mounted on special underwing carriers, and smaller articles are stowed away where space can be found. The businesslike manner in which the plane is loaded is a lesson in military efficiency and co-ordination.

As the plane nears St. Louis, however, another message comes by radio:

"Proceed to Kansas City. Leave cargo there and pick up aluminum castings for Santa Monica."

This change in orders is nothing novel to the pilots who fly the Army transports. Frequently load changes are made to rush material of a higher priority to places where it is sorely needed. The motors, propellers and gas tanks will be shipped to San Antonio on the next plane.

Machine-Gun Sheds Barrel By Pushbutton Release



Pressure on button releases machine-gun barrel

Quick removal of the barrel is a feature of a sub-machine gun, the invention of an Australian soldier, which has become an important weapon in arming men of the British Empire. After firing 300 rounds, the hot barrel of the 10½-pound gun must be replaced, and its simple mechanism makes it possible to complete the change in a few seconds at the touch of a button. The gun is said to be extremely deadly, too, having a greater velocity and deeper penetration, with lighter recoil.

Folding Slippers in Leather Kit Fit in a Coat Pocket

Slippers that fold into a small space are offered in a leather case for travelers and men in the armed forces. The kit, which has a slide fastener, is so compact that it can be carried easily in a coat pocket.



The case is handy for travelers or for service men

m 140

Ninety-Foot Jump in 'Chute Makes Indoor Record



Jumper starting his fall from ceiling 90 feet up

What probably is a record for indoor parachute jumping was achieved by Carl Rupert, expert jumper, when he made his first indoor free fall from a 90-foot height in the International Amphitheater at Chicago. The stunt was performed as a public demonstration of the speed and control attained with a descending parachute.

m 266

War Puts Silver to Useful Work In Industry Instead of Coin

Silver as a useful metal has always been overshadowed in the public eye by silver as a precious metal—the metal of coins and jewelry and tableware. In the wartime economy, however, the industrial uses of silver are coming to the front. The heaviest industrial consumers of silver even in peace were the photographic film makers. Now silver is being substituted for copper,

brass, stainless steel and other "scarce" metals. It is easily fabricated into rods, wire, tubes, strips and sheets and will alloy with most common metals. Sterling silver, which is 925 parts silver and 75 parts copper, is the best thermal and electrical conductor and fine silver wire is replacing copper wire in coils. Silver brazing alloys are used for joints between metals, saving tungsten. Because of its germicidal quality, silver is proposed to replace tin as a lining for food cans, and lead-silver solder is proposed for sealing containers. Silver is relatively plentiful in America, and its consumption in industries and arts in the United States and Canada last year reached a record high of 80,000,000 ounces, nearly double the 1940 consumption.

m-197

Japs Set Fake Periscope Adrift In Attempt to Fool Allies

Japanese seamen have devised a new stunt in an effort to lure United States Army and Navy forces into wasting bombs and shells. Found floating off Pearl Harbor by our naval patrols was a dummy periscope made of wood, bamboo, glass, tin cans and a bit of coral for ballast, apparently set adrift as a "fooler." Authorities say trained observers could spot it as a fake in a few seconds.



One of the dummy periscopes found by navy patrol

POPULAR MECHANICS

m 202 The Lady Patents

Portable Airplane Detector Worn by "Spotter"

Civilian and military airplane "spotters" can convert themselves into mobile listening stations with the aid of a portable plane detector designed for use where more elaborate units are not available. Sound of an approaching plane is picked up by a microphone centered in a parabolic concentrator worn as a headpiece. When a low-pitched sound is heard in the earphones, the listener turns his body until the sound is at its loudest, in which position he will be facing its source and can focus his binoculars swiftly and accurately on the aircraft for identification. The amplifier, batteries and accessories are housed in a carrying case slung over the watcher's shoulder. Three miniature tubes are used in the amplifier. Filters eliminate noises other than those created by airplanes. Volume can be controlled to suit the operator.

Walking airplane "spotter" locates approaching craft by turning until sound picked up by directional microphone and heard in earphones is at loudest point

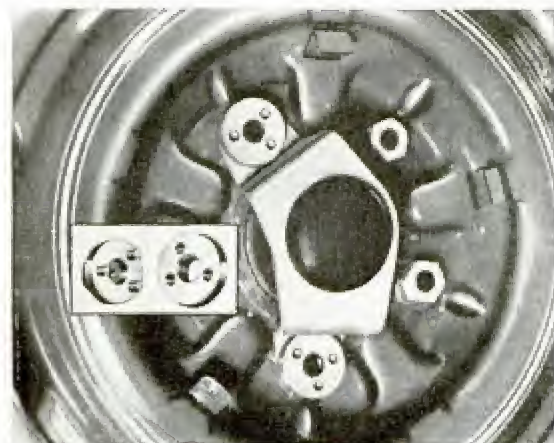


One Boutwell St.
South
Norwalk
Conn

Lock Nuts on Auto Wheels Help Prevent Theft of Tires

Tire thieves would find it almost impossible to remove automobile wheels equipped with the new Pontiac wheel lock. It consists of two lock nuts holding a steel strap over the wheel hub. Replacing the

regular wheel nuts, the lock nuts can be removed only with a special wrench fitting only that particular set.



Locked wheel. Inset, special wrench head fits nut

JUNE, 1942

Message Travels 27,000 Miles To City 700 Miles Away

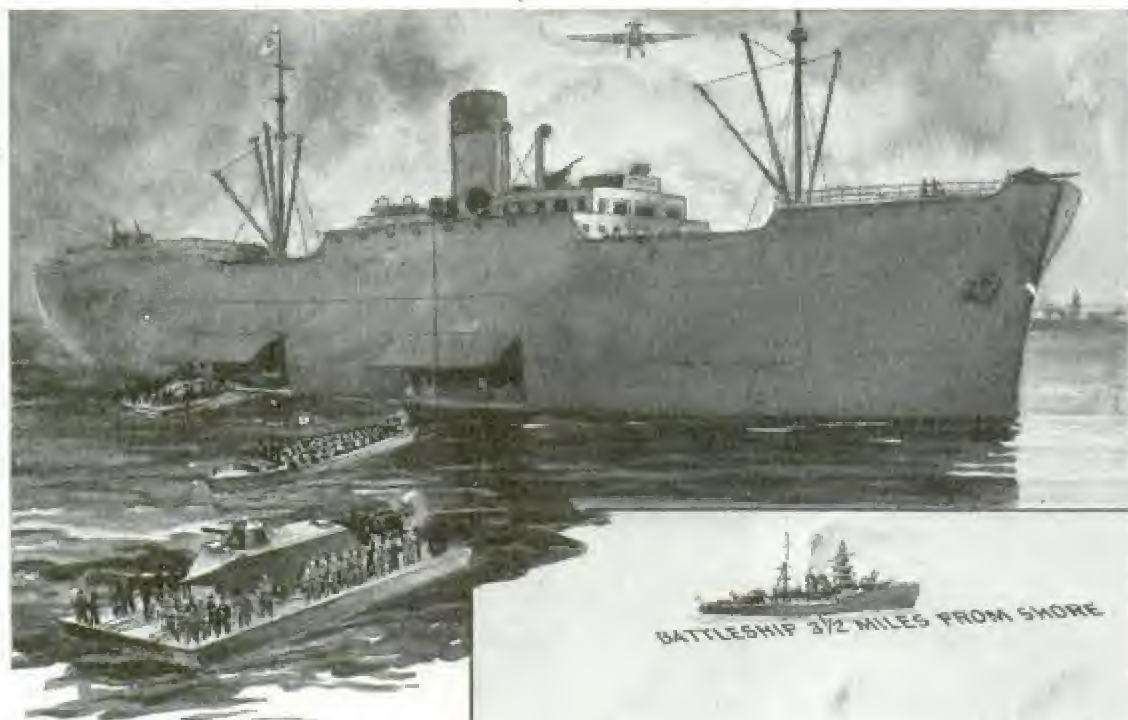
Strange things happen to communications in war. When the Japanese cut the undersea cable between India and Sumatra, there was no direct line over which a bank in Madras, India, could communicate with its branch in Medan, only 700 miles across the Bay of Bengal. Radio service was not available. So the Madras bank sent its message to Bombay, India, by wire. From there it traveled by radio to London, and RCA radiograms leaped successively from London to New York, on to San Francisco and thence to Medan. To span 700 miles, the message traveled 27,000 miles.

Radio Corp of America
30 Rockefeller Plaza
45

sold in Louisa

m 19.6. Newspaper clip.

Hatches in Hull of Steamer Launch Jap Barges



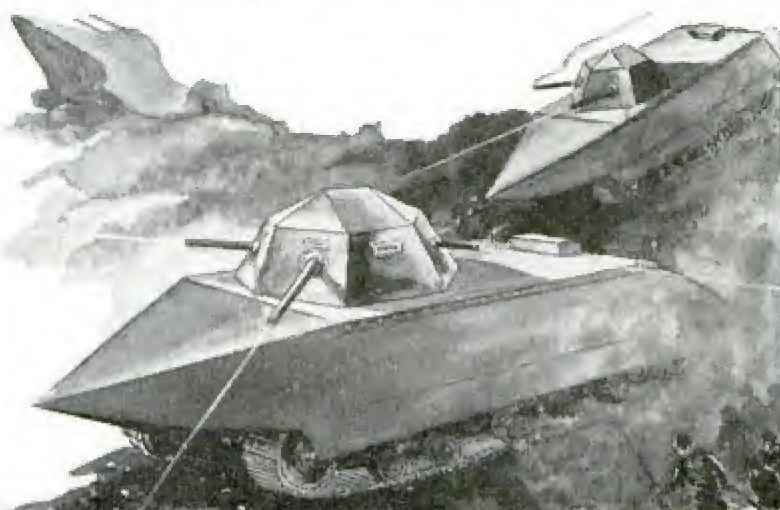
Landing tactics of the Japanese, as disclosed by the U. S. War Department, are illustrated on these pages. Guarded by a line of destroyers close in and a battleship or cruiser $3\frac{1}{2}$ miles off shore, the transports at dawn launch barges from side hatches (above). One type of landing barge is driven by an air propeller



m 196

Warships Cover Landing of V-Shaped Tanks

Choosing a time when high tide occurs in the darkness of dawn, the barges move ashore while howitzers on the destroyers lob shells on the beaches. The Japanese land tanks from whose sharp-pointed prows anti-tank shells usually glance off harmlessly (right); their .50-caliber machine guns fire armor-piercing shells. Observation and pursuit planes cooperate closely; in some cases orders are transmitted by radio from planes to company commanders (bottom) wearing receivers on their chests. Infantry attack forces usually carry only light automatic weapons and grenades



M 22 4.

Hand Cart for Incendiary Squad Carries Water, Sand, Tools



While sand is dumped on blazing bomb, the lid acts as shield

Among the new fire-fighting tools is a small hand cart that carries all the equipment necessary to tackle an incendiary bomb. Its bin contains 200 pounds of sand. You push the cart close to the flaming bomb, tilt it forward to dump a little sand, then pull the bomb into the sand with the long-handled hoe. While you are doing this, the lid of the cart acts as a shield protecting you from the heat. Once the bomb is resting on the sand, more sand is dumped to cover it completely. Then the water tank on the handle of the cart, holding two gallons, is turned over and becomes a sprinkler for extinguishing wood fires started by the bomb. There is also an ax on the side of the cart.

Russia Gets Rubber From Plant Like American Dandelion

After a decade of search for a native plant that would yield natural rubber, Russian scientists have begun large scale cultivation of the Kok-sagyz, a cousin of

the American dandelion. Harvested at the end of the first year, these plants have yielded 4,500 to 5,500 pounds of cleaned roots per acre; and from the roots 150 to 200 pounds of crude rubber were obtained. The Kok-sagyz grows best in black soil rich in organic material, especially nitrogen and superphosphates, and needs over 20 inches of rainfall per year, much of it in the spring. As long ago as 1938, Russia had 170,000 acres of Kok-sagyz under cultivation and expansion to 2,500,000 acres was planned. American agriculturists believe the plant could be raised profitably in this country. After extraction of the latex from the root, the non-rubber constituents might be used for other purposes and the green portion turned into cattle feed.

Scoop for Farm Tractor Lifts and Carts Load

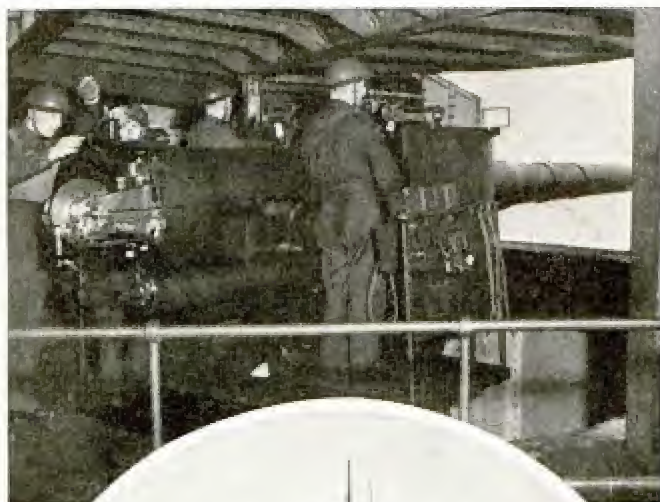
Built for easy attachment to the rear of most farm tractors, a one-man earth scoop and carrier makes for fast, efficient and economical work. Under constant control by means of a hydraulic lift, the scoop excavates earth from one to twelve inches below the tractor wheels, and when full the shovel is lifted clear of the ground and carried away without dragging. The load may be dumped or spread while the tractor is in motion, thus permitting a continuous routine.



Scoop can raise load above ground and cart it away

m238.

Steel Fort in Sea Guards Approaches to Britain



Above, at left, Royal Artillery men at one of the big guns; right, a searchlight bay. Below, the steel island fort

In a steel island fort built up from the sea floor several miles off the coast, a Royal Artillery regiment stands constant guard over the sea approaches to Britain. Big gun turrets fan out in every direction, and searchlights are ready to point the finger at enemy ships or aircraft. The walls are of heavy armor steel. High seas often cut the fort off from contact with the mainland, but despite the limited accommodations and monotonous existence, morale is high.

British combine Photos

m234

Catwalks on Roof of House Give Access to Bomb Fire

If an incendiary bomb ever drops in on Frank Terramorse at his Menlo Park, Calif., home, he's ready for it. He has built catwalks along the top of the house and ladders and steps providing easy access to the rooftop. Barrels filled with water and sand have been placed at the junctions of the catwalks and there are buckets ready for dousing the bomb.

Ladders to the roof, catwalks along the top, barrels of sand and pails of water are ready for incendiary bombs



Prepared for

M-1
 Capt. Thomas E. Linnell Jr.
 3873 Franklin Ave. Los Angeles
 Paul Wells
 California
 Fire Marshall's Office
 Chamber of
 Commerce
 Los Angeles



Fireman adjusting self-contained oxygen apparatus as protection from dangerous fumes at industrial fire

NEW DISGUISES of the DEMON FIRE



A HELPER at an aircraft factory picked up an empty bucket, opened the faucet below a big tank of thinner, and —WHAM! The bucket blew up in his face.

A machinist idly turned his back on the lathe he was tending and a few seconds later the solid bar of metal being cut turned incandescent with heat. Liquefied metal dripped down on the lathe bed and warped the \$30,000 machine out of shape.

Neither of these happenings is part of a mystery story. Each really happened. In each case, fire or explosion resulted from handling materials so new to industry that their special hazards are not widely understood.

Many of the materials that science has developed for our everyday use have their chemical or physical dangers and we have had to build up elaborate safety rules to protect ourselves. Most people, for instance, know that it is foolhardy to hunt for a gas main leak with a lighted match. They know better than to try to revive a dying fire by pouring gasoline on it.

But the aircraft worker who was badly burned when his bucket blew up in his face wasn't violating any safety rule he had ever heard about. No one could imagine what had happened until an expert discovered that the buck-

Painter at Douglas plant working on wing insignia. Big fan behind him carries spray vapors to exhaust system of paint room



Extinguishing gasoline fire with fine water spray that cools gasoline below ignition temperature

et previously had contained chromic acid and that a small amount of dried residue remained in the bottom. That explained everything because he knew that dry chromic acid and the acetone that is an ingredient in most thinners form an explosive mixture that is as certain to "take off" as T.N.T.

Today in that plant, as in most others where chromic acid is used to prepare metal surfaces before painting them, such acid is handled only in brightly colored containers that may be used for no other purpose. Properly used, it is entirely safe.

Studying various types of nozzles used in fighting different kinds of fire





Demonstrating how sand is thrown out of tube to blanket fire like that of burning magnesium



"Dope room" worker at Douglas plant depositing matches as he enters working quarters

The metal bar that caught fire seems mysterious but it was only another case of a new material that must be handled properly. The bar was composed of magnesium, the light metal that ignites at temperatures comparable to most woods. Ordinarily, when magnesium is being worked in a lathe, it is kept cool by a stream of cutting

oil or other coolant that constantly pours over the metal. In the case above, scraps and chips had clogged the cooling system and stopped the flow just as the machinist turned his head. Within a few seconds the bar had built up enough heat from friction with the cutting tool to ignite. Repetition of the accident was prevented by installing a filter screen in the cooling system to avoid such clogging.

Thousands of tons of magnesium are being used every year in aircraft manufacture alone and its properties of lightness and strength suggest that it will be even more widely used in the future than it is today. Magnesium is perfectly safe as long as it is used with proper caution and as long as good housekeeping is observed in the shop while it is being worked. Scraps and filings must not be allowed to accumulate around lathes and saws. In many plants such cuttings are removed with a whisk-



Rookie firemen learning to use nozzle that throws a heavy stream of water

broom almost as soon as they fall. Magnesium scrap goes into special containers and shouldn't be mixed with other scrap. Especially it should not be mixed with iron scrap because the combination of these two metals forms one of the hottest fires known, once ignition has taken place. Fire prevention agencies and fire fighters long have been looking for a satisfactory extinguisher for magnesium fires. The trouble with magnesium is that the metal is a great thief of oxygen and steals oxygen from water or any other material containing it, thus increasing its own combustion.

Apparently the best extinguisher so far devised is a mixture of several viscous liquids and carbon dioxide, a combination perfected by Michael Farris of Vega Aircraft Corporation. This extinguishing agent, used in the Vega machine shop, has put out minor magnesium fires in lathes and milling machines in a matter of seconds.

There are only two ways in which a fire of any sort can be extinguished before it consumes all the flammable material it can



Fireman standing by with extinguisher as motors are tested

reach. One way is to blanket it away from the oxygen it needs, and the other is to cool it down below its ignition point. Magnesium, however, contains enough oxygen to keep going even when smothered with dry sand, and its fire is so hot that it can't be cooled below its ignition point by ordinary methods.

An instance of the odd way in which a material that apparently is safe can cause a bad fire happened at sea a short time ago. Fire started in a ship's hold that contained cases of photographer's flash bulbs and a quantity of industrial alcohol. These items are considered safe cargo and there seemed no way in which the fire could have started.

It was a real mystery until one of the inspectors, exasperated by the puzzle, threw down a flash-bulb he had been holding. The bulb broke, of course, and shortly



Cleaning up magnesium scrap in airplane company's machine shop reduces the hazard of fire



Portable fire-fighting equipment of type used in airplane factory

afterward a newspaper it was lying on broke into flames. Now there were two mysteries instead of one. Investigation showed that this type of bulb, manufactured under foreign patents and perfectly harmless in its intended use, contained a chemical mixture that was apt to self-ignite when exposed to air, as when an unused bulb was smashed. A few bulbs broken in a rough sea—that was the answer to the fire at sea. Sale or transportation of this brand of bulb is now forbidden, so don't worry about this hazard the next time you buy flash bulbs for your camera.

A good example of how proper precautions will safeguard a hazardous material is the way liquid petroleum gases including butane and propane are now handled. These hydrocarbon gases are used in some parts of the country as a truck fuel and for heating. They are stored under pressure in big metal cylinders.

Butane is as safe as gasoline when it is treated properly but its hazard wasn't fully understood five years ago when it first came into general use. Disastrous fires and explosions occurred, mostly from leaking containers. In one case a truck fueled with butane and parked at the curb was struck

a sharp blow by another car being parked behind. The blow damaged the pressure fuel tank and leaking gas flowed across the sidewalk and into a restaurant. Finally it reached the fire of a cooking stove in the rear. The resulting explosion did as much damage as if a bomb had been dropped.

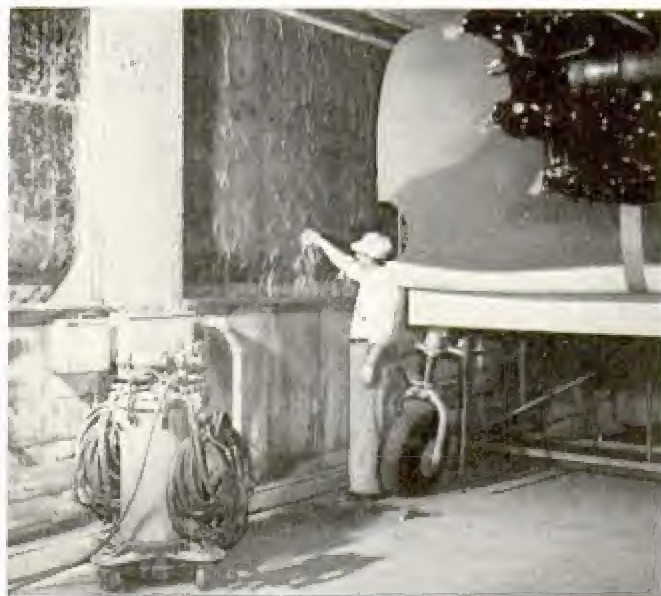
Butane is a heavier-than-air gas and tends to flow down hill. It is apt to accumulate in pockets and remain there until a match or cigarette touches it off. Today butane installations in trucks are armored against the hazards of road shocks and collisions. When used for heating, present precautions are to install butane tanks out in the open, isolated from buildings, and protected from mechanical injury. Butane is as dangerous as gasoline when handled carelessly, and is as safe when handled properly.

Practically all the modern fast-drying paints and lacquers are dangerous under certain circumstances. Such paints in drying throw off a flammable vapor that in proper concentrations will ignite from any open flame, and sometimes over surprisingly long distances.

In industrial paint rooms, such as the department at the Douglas Aircraft Company where aircraft assemblies receive their camouflage paint and identification markings, this hazard is minimized by fans

(Continued to page 168)

Testing water curtain that picks up pigment in air of paint room



m/s.s General Electric Co. Schenectady N.Y.

"Big Gun" Cuts 230,000-Volt Line in 1/20 Second

Standing guard over the transmission line carrying power from the Bonneville hydroelectric plant to the war industries of the northwest is the fastest oil circuit breaker in the United States. It takes this huge electric robot just 1/20 second to interrupt the flow of 2,500,000 kilovolt amperes at 230,000 volts if a fault occurs in the transmission system.

Fastest-working oil circuit breaker in the land is this one, looking like a futuristic big gun as it guards the 230,000-volt power line of the Bonneville electric plant



m209

Wheel Reveals Accident Risk When Two Drivers Meet

Automobile drivers can be enlightened quickly concerning the degree of peril involved when various kinds of unfit drivers pass on the highway, with the aid of a "wheel of chance" constructed in modified form. It is used at the California Division of Drivers' Licenses, where persons wishing to learn rules of safe driving attend classes tutored by state driver's license examiners. The periphery of the wheel is

divided into sections indicating various good and bad driving habits, and each is assigned a number from 0 to 9, the numbers getting higher as the probability of accident increases. For instance, alert and keeping good distance are assigned 0, speeding 3, drowsy 8 and drunk 9. Spin the wheel and two arrows point out two types of drivers, designated as A and B. Adding the numbers indicates their chance of becoming involved in an accident.

Lourence Sherman



Spin of wheel shows chance of accident when two cars meet

If the number totals five or more, it is believed an accident would result. In one example, driver A disregarded a boulevard stop sign and had a rating of 4, while driver B failed to signal for a turn, numbered 2. The total being 6, an accident would result. However, if either driver had been alert, with 0 for his number, the total would be less than 5 and there would have been no chance of accident.

¶All the light bulbs in the United States, burning simultaneously, would produce the equivalent of noon sunshine over a little more than a square mile.

JUNE, 1942

*Dept of Motor Vehicles
25th and I Sts.*

*Georgia Tech Engr.
Lab. 42*

HIT OR MISS



Right-handed hitter crossing plate on way to first base after making a hit

Catcher snatches off his mask as he prepares to try for a high foul ball near home plate



HAVE you ever hit a dozen balls in a row in batting practice and then struck out your first time at bat in a game? That often happens.

The reason is that the man who pitches to you in practice isn't trying to fool you, while an opposing pitcher uses every trick he knows to make you fan out. Good baseball is as much a game of wits as of skill. When you are at bat, you and the pitcher are opponents in a battle of hit or miss. And he has the edge.

It's your job to try to decide what's coming next so you can get ready for it. The pitcher's job is to throw almost anything you aren't expecting. It may be a ball or it may be a strike. If it's a strike it may be a fast pitch or a slow one or a curve. You have only a fraction of a second after the ball leaves his hand to judge the type of throw.

Your strategy starts the minute you reach the plate. The catcher is the first man you must fool because he sizes you up and signals the pitcher what to throw. If you are all tensed up the catcher senses it and he may call for a wide ball that you are apt to swing at even if you can't reach

21339

it. To relax your muscles at the plate, bend your knees and crouch down a couple of times.

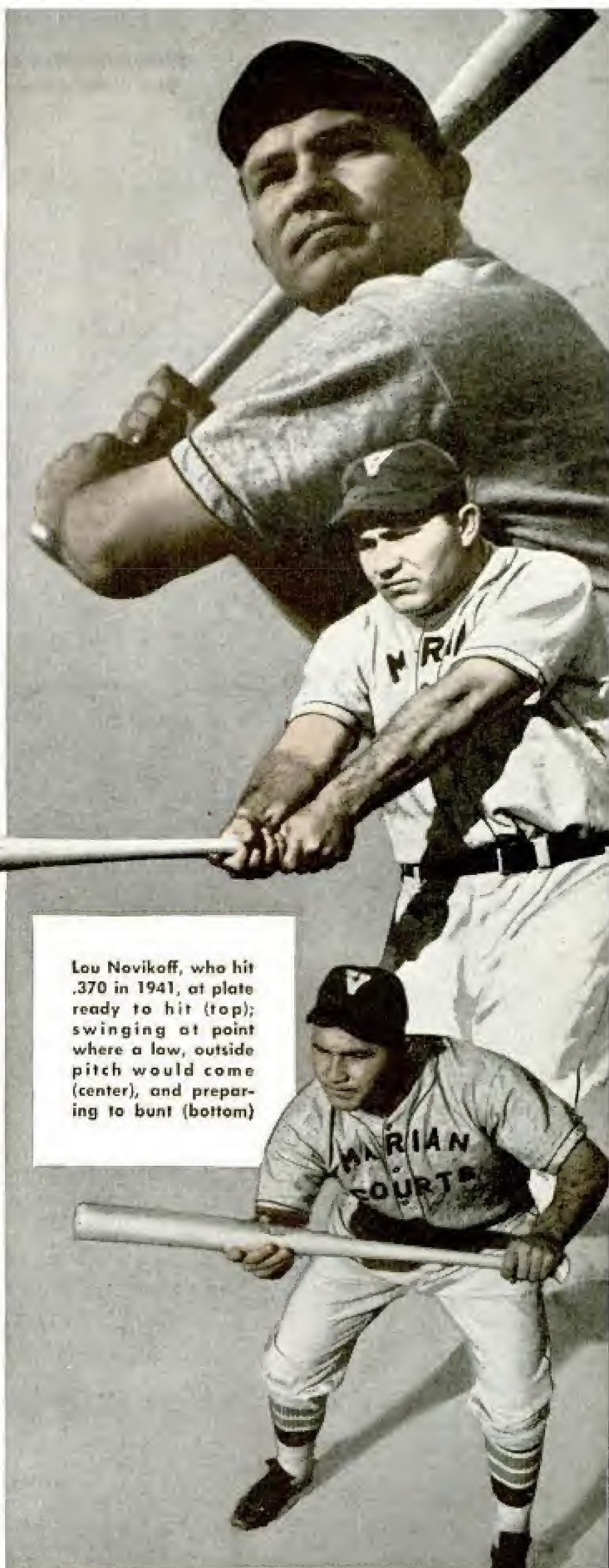
Another thing the catcher watches is where and how you stand. If your position is awkward he may call for a strike right down the middle, knowing that it will find you off balance. Sometimes a batter is smart enough to stand in an awkward position purposely and then, just at the pitch, change to an easy stance that gives him full control.

If you are poor at reaching a high pitch, practice a high swing at the plate. The catcher may decide that you are all set for a high one and he will signal for a low throw, right where you want it. If you hold the bat all choked up you won't be able to reach an outside pitch and the catcher probably will be smart enough to call for one. If you think you know what sort of throw the pitcher is going to make next, don't advertise the fact by getting all set for it. The man behind you will signal for a different one.

How can you tell what the pitcher is going to throw next? You can't, always, but here are some tips from Lou Novikoff, leading hitter in the American Association in 1941, that may help:

"If he pitches a ball, the next one quite likely will be a strike, because pitchers like to keep trying something different. If a pitcher gets two strikes on a batter he feels pretty safe and is apt to throw a couple of balls. But if two balls have been called and no strikes the chances are a strike is coming up next.

"A pitcher tries not to signal what he is going to throw but many of them have mannerisms that give them away. One may betray the fact that he is about to throw a curve by the special way he steps, taking a shorter stride or planting his foot more to one side than usual. Some of them can't help making a face as they get ready for a curve. Another may



Lou Novikoff, who hit .370 in 1941, at plate ready to hit (top); swinging at point where a low, outside pitch would come (center), and preparing to bunt (bottom)

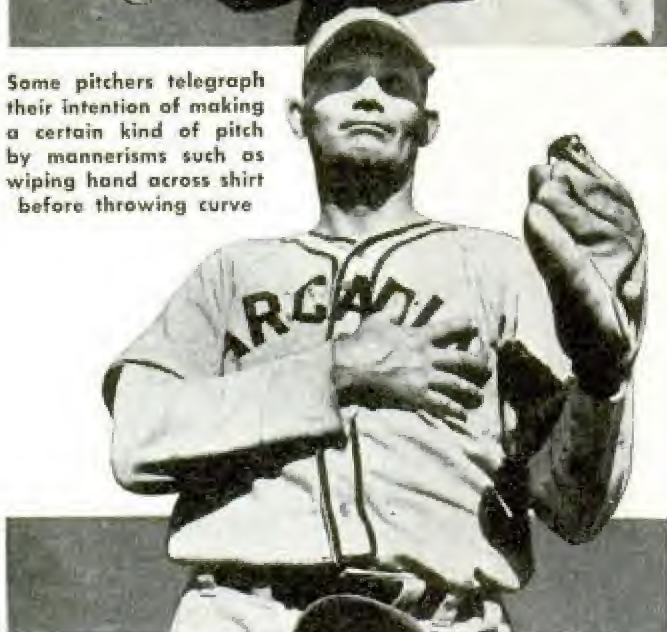
10324. Washington Aero. South Gate Calif

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Pitcher demonstrating two mistakes, one in holding ball with typical curve grip and the other in failing to conceal ball with his glove



Some pitchers telegraph their intention of making a certain kind of pitch by mannerisms such as wiping hand across shirt before throwing curve



Unconscious habit of wetting his fingers before throwing a fast ball soon betrays the pitcher's intention; opponents study a pitcher's actions

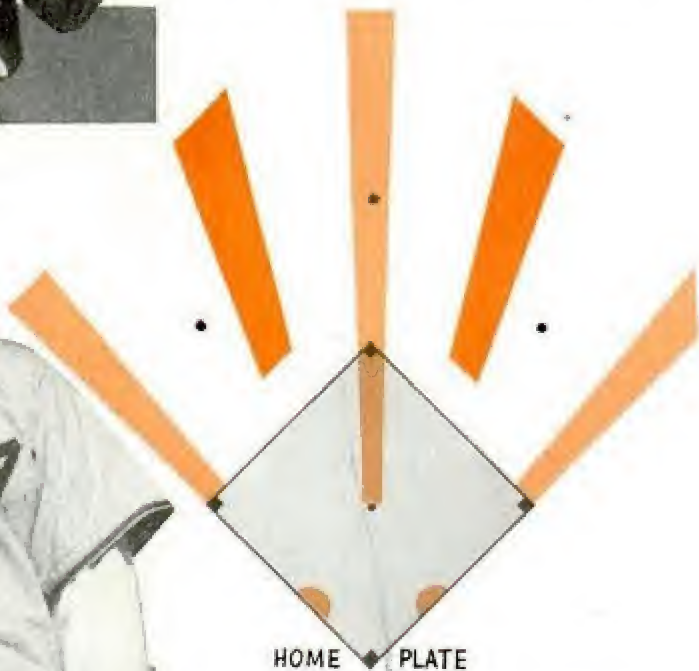


wipe his throwing hand across his shirt to dry his palm. Many of them throw curves with an overhand motion and the batter knows what is coming the minute he sees the arm go back.

"Some pitchers make a habit of leading off with a fast pitch. But don't be too sure that he will keep it up, even if he has done so for three innings. Just then the pitcher may start drifting them to one side, knowing that the batters are all set for fast ones.

"A tired pitcher loses his stuff and is easier to hit. When a manager can see that the opposing pitcher is getting tired he usually tells his batters to start swinging, especially if the score is close."

Stealing bases is almost a lost art now compared to the emphasis that used to be placed on this part of the game. A runner who has reached first is a long way from home, but if he can steal second he is apt to score the next time a long drive is hit. So, a fast runner can afford to take a chance stealing second unless he has been told to play it safe. He leads off as much as he dares, watching the



Shaded areas indicate parts of playing field in which the most safe hits are made; note bunting areas near plate



Runner caught in trap between bases; running the bases is almost a lost art

pitcher alertly because he must beat the ball back to first base if the pitcher tries to throw him out.

There is nothing hit-or-miss in the way the batting line-up is arranged. The first man at bat has only one duty and that is to try to get to first base. He must be able to hit safely and he must also be calm enough to wait it out and take a base on balls if the pitcher seems wild.

The second man in the line-up has the job of advancing the runner to second base no matter if he sacrifices himself in doing it. He must be a fast player who can bunt perfectly and he is preferably a left hander. A left-handed batter is two steps closer to first base and has a better chance to beat out a bunt. If the second man up has a chance for a long hit he should try to pull the ball over to right field behind the runner advancing to second, to reduce the chances of a double play.

The next three men up are the heavy hitters of the team. Their job is to bring home the men on bases. This is the spot for a home-run hitter, who sometimes drives two or three men ahead of him across the plate. Next come the weak hitters with the pitcher last. The pitcher is usually the weak-



Novikoff at completion of swing; note weight is properly distributed to achieve good balance—one secret of good hitting

21337



Catcher signaling for pitch as batter stands at plate

est hitter and, in last place, he is apt to bat less often, conserving his strength.

The pitchers who are hardest to hit are the relatively few who "pitch out of their uniforms." Such a pitcher releases the ball toward the end of the throwing motion, when his body is behind the ball. It's easy to see the ball when the pitcher lets it go from above his shoulder but it's hard to see a ball against a light-colored uniform.

In the old days of baseball, managers tried to take advantage of this fact by playing tricks with the backfield fence. One such fence had a dark green panel behind the pitcher, an ideal background when the home team was at bat. But this panel was turned around to reveal a glaring yellow green surface when the visitors were up.

Another team placed a green advertising sign in the shape of a big disk on its backfield fence. It formed a perfect background when the home team was batting, yet the visitors could hardly ever hit the ball. Someone finally noticed that at the instant the home pitcher was throwing, the sign spun around, creating a moving background against which the ball was almost invisible. A boy behind the sign was spinning it with a crank.

Early in the century baseball teams tried all sorts of tricks to help them win. The grounds were "doped" in half a dozen different ways. Sometimes the area toward first base was hardened so that balls bunted to the spot bounced high in the air. The home team knew just where to bunt. Base lines were banked up to help prevent bunted balls from rolling foul. Often the pitcher's slab was elevated or depressed to suit the style of the home club's pitching staff. The grounds would be softened by soaking with water overnight before a game with a fast team, to help slow the visitors down. One stunt was to "soap" the dirt around the pitcher's box so that a visiting pitcher, reaching for dirt to dry his hand, got a greasy hand that made the ball slippery in his grasp.

All such tricks as these that give one team an advantage over another are obviously unfair.

Modern baseball is played by teams that depend on their skill and wits alone to win. And often enough, a team that uses its brains will beat a team of better players who just aren't thinking as fast.



Ball delivered from over shoulder is easy to see

Hands "Float" on Face of Transparent Clock

You could puzzle your friends with a transparent Mystery Clock now on the market. Its hands seem to float on air, since their means of support is not apparent except on close examination. However, manipulating the setting knob reveals the secret. The hands are each mounted on a separate glass disk framed in a metal ring. On the outside edge of the metal rings are teeth which engage rotating gears hidden within the base of the clock, where the tiny electric motor also is located.



Hands of Mystery Clock moving about the transparent dial have no apparent connection with the mechanism

Heater With Removable Casing Gives Access for Cleaning

Easy access for dusting the inner surfaces of a console-type oil or gas heater has been provided by equipping it with a detachable outer casing. Unscrewing four



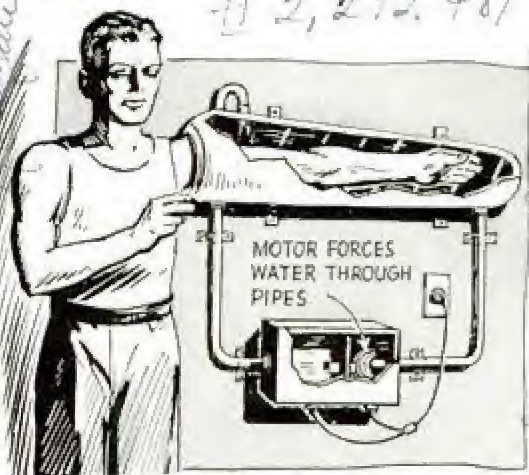
Outer shell of heater lifts off for cleaning inside.

wing bolts and lifting slotted metal pieces releases the covering, which can be accomplished while the heater is in operation, thus permitting the periodical removal of dirt before it escapes upward to lodge on walls and ceiling. In the salesroom the removable jacket allows the customer to examine the interior of the unit. Repairs and servicing are also simplified.

(To learn where to buy commercial products described in these pages, see the index.

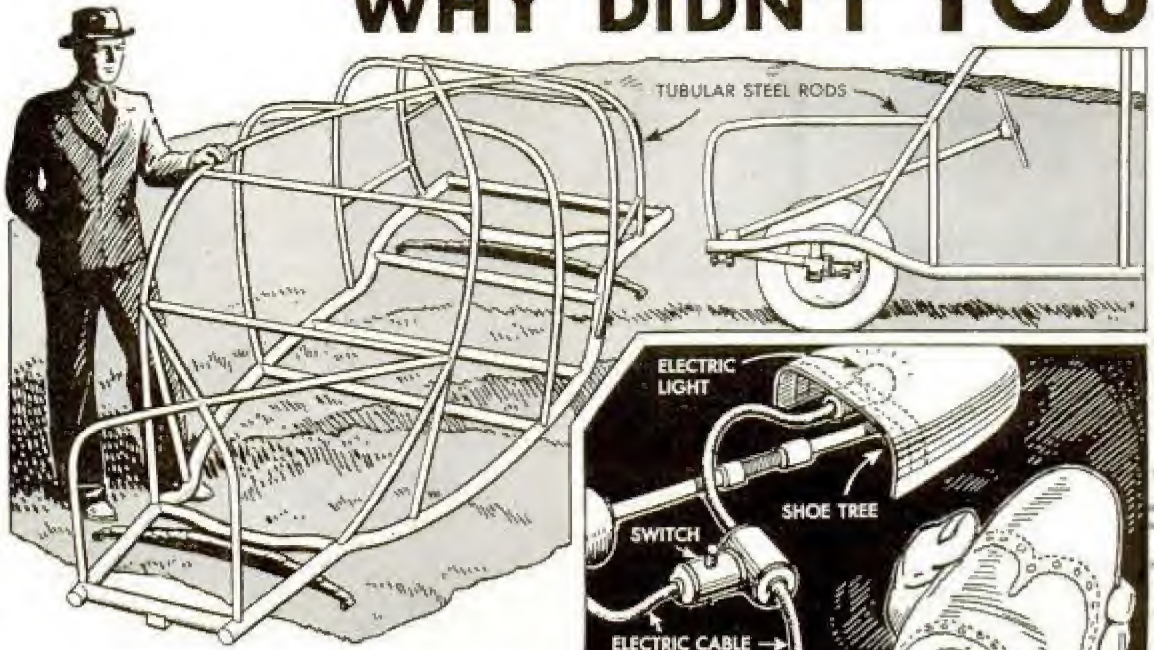
Liquid Massage for Arm or Leg Is Given in Sealed Tube

Two Ohioans have patented a machine for administering a local treatment or massage by circulating liquid in a sealed tube into which the part to be treated, such as an arm or leg, is thrust. A seal at the open end of the tube prevents leakage. As the liquid is forced through the tube, ribs inside the tube impart a helical motion to the circulating fluid.



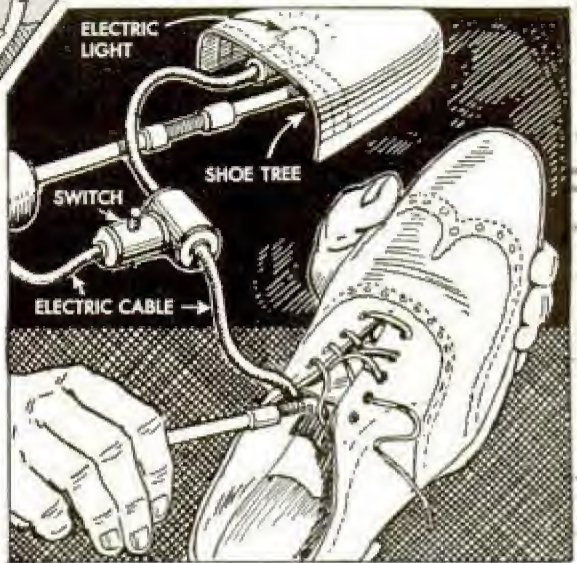
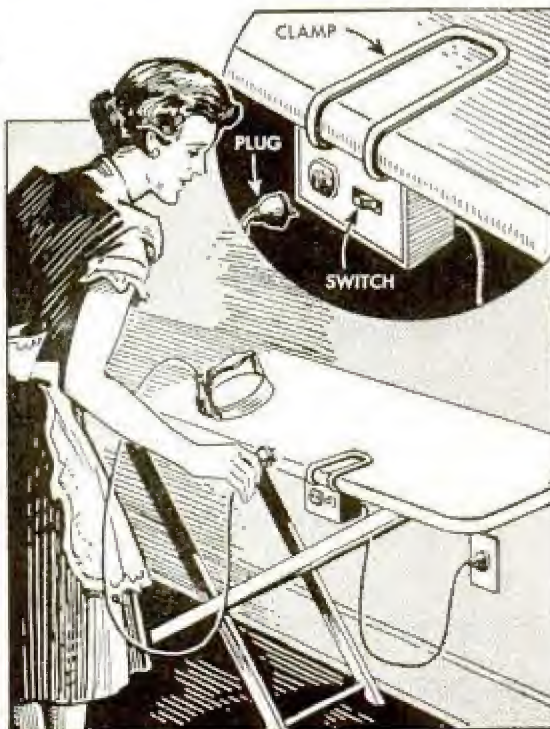
Forced circulation of water through sealed tube has the effect of a massage on arm or other part of body

WHY DIDN'T YOU



A hint of how the automobile of tomorrow will be constructed is found in two patents granted to the Ford Motor Company. They deal with a vehicle body composed of tubular-shaped members, a form of construction akin to methods employed in light airplane factories

Dragging extra lengths of cord around on ironing day may be eliminated by a U-clamp attachment which permits plugging in the iron just beneath the board instead of a distant wall socket. The attachment clips on the edge of the board



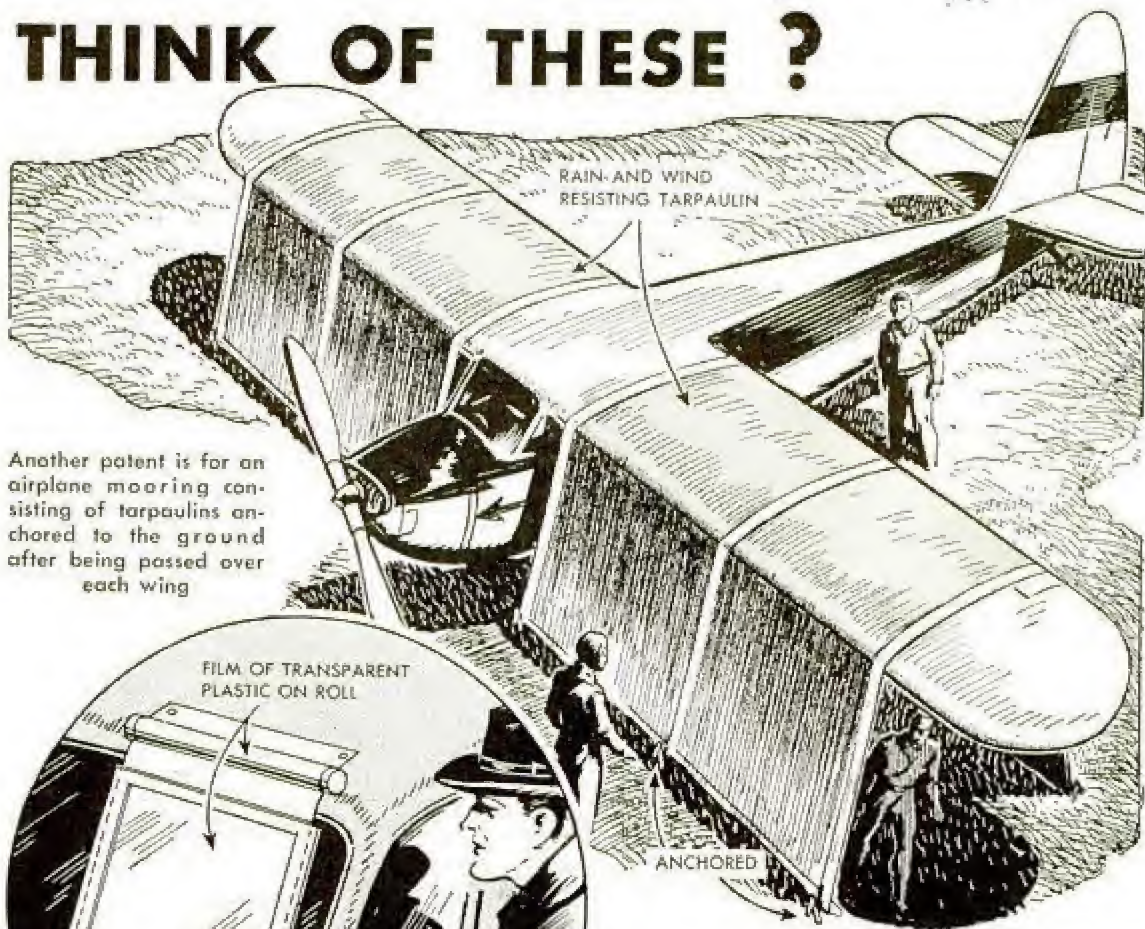
Shoes not only may be held in shape by a patented shoe tree, but may be dried out by the same means. Electric bulbs within each tree provide heat

(Since we have not been advised that items on these two pages are available commercially, Popular Mechanics Magazine cannot supply information to prospective purchasers; granting of a patent is no indication that an item is ready for the market)

A device for attaching under the front fender of an auto has a pendulum that releases sand for increased rear-wheel traction. The pendulum swings forward when car is stopping, backward when it is starting

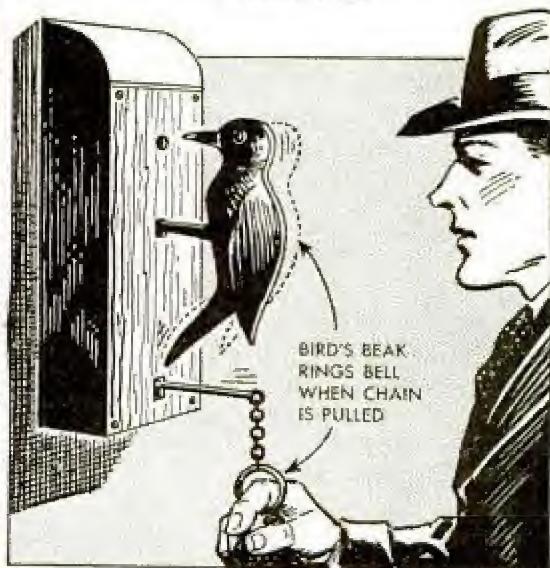


THINK OF THESE ?



Auto windshields could be kept clean by means of transparent film. When film becomes dirty, it is replaced by rolling a clean section off a spool beneath windshield. At the same time the dirty film is rolled onto spool above windshield

A "woodpecker" doorbell would be a novel touch for the suburban or country home. When chain is pulled by visitors, woodpecker's figure set on pivot rocks forward and the beak strikes sound-producing bar



m 214.

Tin Cans Easily Salvaged By Cutting Off Ends



Tin can flattens easily after both ends have been cut off, in which shape it takes less storage space

Tin cans may be salvaged with little difficulty and they do not take up much space if the correct procedure is followed. After removing the top of the can and rinsing it thoroughly, the can is easy to flatten side-wise if the bottom is also removed. It is best to leave a quarter-inch space inside for inserting the cut-off ends. This space also permits chemicals to circulate through the metal in the recovery process.

than when overcast, since the clouds act like a blanket and hold the heat around the earth so little or no dew is precipitated out of the atmosphere. "Rain before seven, clear before 11," is true of certain kinds of showers. As a high-pressure area moves in to replace a low one, there may be a short, hard shower, preceded or accompanied by a shift in wind from southerly to northwesterly. If one of these showers starts before seven o'clock in the morning, it will probably stop before 11. "Mackerel sky, not 24 hours dry," also is based on fact. Cirrus clouds, coming from the west with a low pressure area, may soon spread out to become the characteristic mackerel sky, and, if the low pressure continues for the next 24 hours, rain is quite likely. When the underside of tree leaves can be seen, it is said to portend rain, because during a cyclone, or low pressure area, the air tends to rise, turning the leaves over. The professors advise farmers and gardeners against planting only under certain phases of the moon, because this can hardly have any telling effect on the plants, especially when their growth continues while the moon makes two or three trips around the earth. A good crop, they assert, depends rather on careful preparation of soil, planting the seed on time and correct cultivation.

m 218

Brush With Bristles at the Side Cleans Crevices and Edges

Crevices and grooves hard to clean are easy to reach with a household brush having side bristles. Efficient as a hand and nail brush, it also gets into deep-cut designs in woodwork and furniture and scrubs the inner edges of kitchen utensils.



Side bristles broaden usefulness of brush which is handy for many jobs in the kitchen, bathroom, etc.

Dependable Weather Sayings Have Scientific Background

Amateur weather forecasters basing their predictions on folklore would have better luck using only the sayings which have a scientific background. Professors Ralph Clauser and Louis C. Jones, of the New York State College for Teachers at Albany, have outlined a few which may be depended upon. They agree, for instance, that dew on the grass in the morning may forecast a fair day. Dew, they explain, forms more readily when the sky is clear

POPULAR MECHANICS

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merchandise mas.

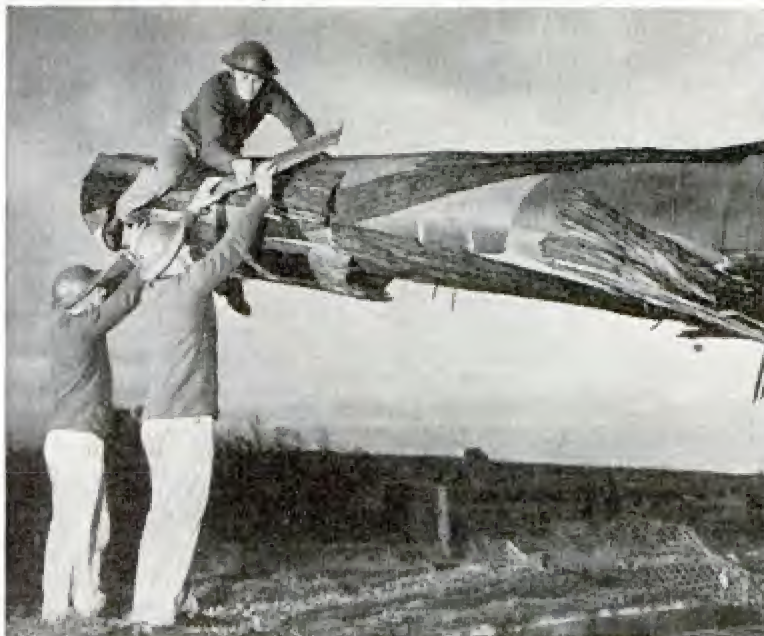
M 232 2950 Atlantic Air
Plug Is Rammed Into Gas Main Set Afire in Raid

Flames spouting from a gas main severed by an enemy bomb may be quickly extinguished by ramming into the broken main a special plug fitted on the end of a long pole. More than 2,000 volunteers are being trained by the Brooklyn, N. Y., Union Gas company for this sort of emergency work. The men wear asbestos hoods and gloves and are provided with ramrods and plugs, which have a rubber washer that fits tightly in the pipe.

Plugging a broken gas main in a "dress rehearsal" for air raid



M 233
Coast Gun Is Clad in Bark to Hide It From Enemy Eyes



Perhaps barking dogs don't bite, but the bark on the big Canadian coast guns is just camouflage. They have plenty of bite. These long-barreled guns, pointing out into the Pacific, are being covered with strips of bark instead of the usual mottled camouflage paint, on the theory that they will resemble fallen logs to enemy aerial observers.

Canadian artillerymen on the British Columbia coast dress their big guns in strips of bark, borrowing from nature for effective concealment

M 230
Metal Parts for Repairing Skull Are Now Ready-Made for Surgeons

Ready-made metal plates now available for repairing defects in human skulls may be useful in the care of war wounds, according to Dr. Claude S. Beck of Western Reserve University school of medicine. The plates are made of the alloy, vitallium, which has been used successfully in repairing skull and other bone defects. Heretofore the plates have been cast specially

from a pattern of the skull defect, but it was Dr. Beck's idea to have plates made up in various sizes and kept in stock by surgeons who could use them as needed. The plates have a gentle curvature which may be altered by means of pliers to fit almost any case. If the wound is not infected, the plates, attached by vitallium screws, might be put in at the first operation.



Since weight is important in water bugs, a small driver has the edge over a heavier one. Here one of these marine jockeys is carrying his hull and engine down to the water for a run

IF YOU like to race an outboard and the high cost of competition has you stumped, try racing a midget.

These baby boats are inexpensive, use 7½-horsepower motors, and were developed for novices.

Seems too tame for you? Not unless hitting 40 miles per hour with a hull that is only seven feet long seems tame. Not if it's tame to ride a boat so touchy that it is apt to stand on its stern and spin over if it hits even a floating cardboard sparkplug box.

The midgets are the current sensation in outboard racing. Professional drivers are entering the class because racing the tiny hulls is so exciting.

The driver of a midget can pick up his boat in one hand and the motor in the other. The hull weighs 50 pounds and hull and driver together must weigh at least 200 pounds. A heavy driver is handicapped. During a race, the driver crouches on his knees in a boxlike cockpit so tiny that he has to cut down the back of his life jacket to prevent it from stuffing the carburetor intake of the motor behind him and shutting off the flow of air.

A midget is so sensitive that if the driver shifts his weight a couple of inches forward, he kills his speed. He uses his body instead of the throttle for changing speed in the turns. The throttle, incidentally, is automatic and kills the motor the instant the driver releases his grip, to cut down the chances of trouble in a spill. Being so light, the midgets are rough boats to ride, yet their lightness helps them speed over choppy water that would trip heavier hydroplanes.

Ref: Kent Hitchcock
Box 686, Ballou's Bay, L1082



Two midget outboards race for the finish line. Notice how small the hulls seem in relation to drivers

The speed record for the class is 41.65 miles per hour and the chances are that even faster speeds will be made this season or next. Even the present record seems phenomenal in view of the fact that outboards of many times the midget horsepower can hardly go twice as fast.

A midget racing motor costs \$131 and a factory-built hull costs \$150. You can build a hull cheaper and it may be better or poorer than factory construction. From

\$200 to \$400 will put you in midget competition as against several times that amount that is necessary before you have much chance of winning in the larger classifications. The costs of racing outboards have been going up in proportion to their increasing speeds because of the extra motor work and hull refinements that are necessary for speed. In spite of high speeds and the chances of spills, outboard racing remains one of the safest sports as long as

As racer rolls over at 40 miles an hour in rough water, driver is thrown out—his arm visible below boat





Drivers drop steering wheels to pass batons at a tense moment in relay race. The other hand keeps grip on automatic throttle



Left hand of driver is at the automatic throttle he must grip throughout race to keep motor going

proper equipment is worn and the safety rules are observed. Crash helmets and life jackets are obligatory.

Winning a championship in any outboard class is a matter of perfection in innumerable details. The motor, the propeller, the hull, and driving skill must all be tip-top. The slightest carelessness, even strapping the hull down improperly when towing it behind a car and thus warping its shape, may be enough to lose a race. Some of the smartest drivers spend as much time eliminating things that tend to slow them down as they spend in trying out ideas to increase their speed.

Drivers win few races when they use a

motor exactly as it comes from the factory. Each owner spends long hours working over his power plant, principally to insure perfect alignment of parts, to reduce friction, and to improve the piston seal. Mufflers are replaced with exhaust stacks to provide better cooling. A cool methanol-base fuel at a dollar a gallon is used because with it pistons may be fitted tighter. Generally speaking, no material may be added to a motor except for reinforcing.

Mechanical ingenuity has devised scores of slight modifications to improve outboard motor efficiency and the hunt for more ways to extract additional power from the motors is still going on. Even

Below, buffing surfaces of cylinder head with a tool mounted on a dentist's drill

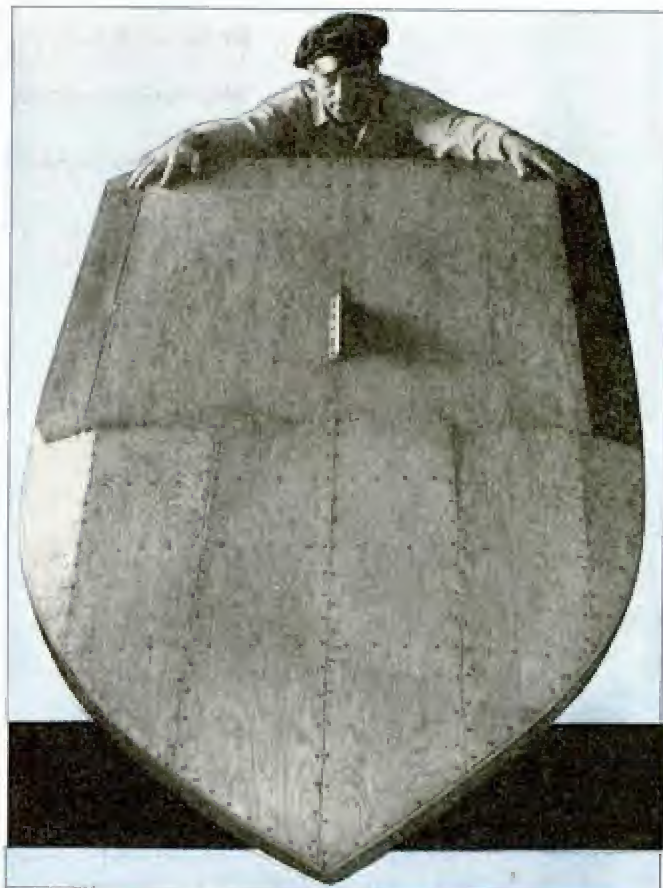


L 1082

such a detail as equalizing the tension on the cylinder head nuts is important. Some drivers chrome-plate their cylinders to insure smooth surfaces and to help increase piston seal. As much as six miles per hour may exist between two sets of pistons and the way they fit with the cylinders. Occasionally a driver discovers or perfects a pair of "record" cylinders that just happen to be perfect and with which race after race can be won. Cylinder walls in the small motors are thin, and unevenness in the metal may be disastrous, because if the heat dissipates unevenly the motor may heat up and freeze on a straight-away run, corkscrewing the boat over in a flip if the propeller blades happen to stop in a horizontal position. In perfect shape, a midget motor may turn 6,500 revolutions per minute and develop up to 10 horsepower.

Stainless-steel propellers are thinner than bronze blades and hence are best for some conditions. The fastest design of propeller for a speed dash is not the one to use in a closed course race, for which a propeller with slightly less pitch delivers the fastest get-away in coming out of the

Propellers to suit all conditions are carried in case



Rubbed-down coats of varnish give bottom a glasslike surface

turns. All propellers have slight variations and a driver who is out to win may test half a dozen before selecting the best. Recently a device was perfected that takes the measurement of propeller surfaces and aids in building up or reducing the metal to provide the right curve at all points. Five miles per hour or more are sometimes added to a boat's speed simply by this "true pitch" operation.

Most hulls are built up of spruce frames with a plywood bottom and linen deck. Average dimensions are 84 inches long and 43 inches wide. A flat bottom with one step that keeps all but part of the rear planing surface out of water is one of the fastest designs although a trend is growing toward a type that the drivers call three-point suspension, in which at high-speed the hull floats on its stern and on two pontoonlike attachments fastened to the hull forward of amidships. Difficult to balance, a three-point boat is very fast when it is working smoothly.

One driver has put nine different bottoms on his midget, each one a little faster

(Continued to page 170)

Chaining Tires and Wheels Helps to Foil Thieves



Chains lock tires and wheels to the nearest bumper

It required only the application of a simple idea by one automobile owner to protect all four tires and wheels from thieves while the car remains parked on the street overnight. A stout chain, strung through each wheel, secures it to the nearest bumper, and each chain is fastened by a padlock.

Ice Cubes Frozen in Plastic Cups Lifted Out One at a Time

Frozen in individual flexible cups, ice cubes may be removed from the refrigerator tray one at a time without touching the ice with the hands. Twelve cups are racked in a steel tray, and it is not necessary to remove the tray from the refrigerator when lifting out one of the cups, since cups come out easily without the use of levers or dousing the tray in water. Made of

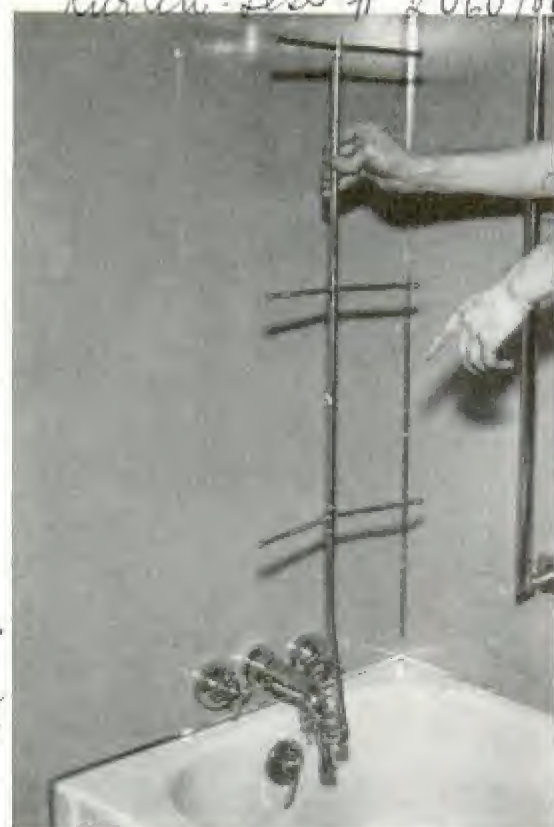


Ice cubes in individual cups removed one at a time

transparent plastic, the cups are strong enough to withstand long use, and the ice tumbles out readily when the sides are pressed lightly with the fingers. Frozen cups may be stored in the refrigerator cold compartment or chill tray without fear that they will stick together.

Bath Tub Shower Fits Any Spout And Requires No Curtain

Usable without a curtain because it does not splash, a bath tub shower now available may be attached to any faucet by means of special adapter clamps. The fixture is an upright tube with three perforated cross pieces giving nearly horizontal



Shower for your bath tub sends spray from cross arms

streams that can be regulated from a gentle to a powerful spray. A standing shower can be taken without getting the face or hair wet. Installation of the unit does not interfere with other uses of the tub or faucet, since water may be run directly into the tub instead of through the shower by turning a collar at the base.

(To learn where to buy commercial products described in these pages, see the index.

m 195 Liberty Coach Co. Greener Ind.

Telescoping Trailer Adds Three Bedrooms

Twice the usual sleeping accommodations are offered in a telescoping house on wheels which has an upper story that may be raised when the trailer is parked. The walls of the top floor telescope over the bottom portion, and the operation of raising or lowering, accomplished with a hand crank, takes only 10 minutes. In raised position the upper section rests on wooden blocks, which are removed when it is to be let down. The top floor contains three rooms partitioned by venetian blinds, and all of the space may be used as sleeping quarters. An inside stairway connects the two floors.



Trailer, top, in full height; bottom, top story being lowered

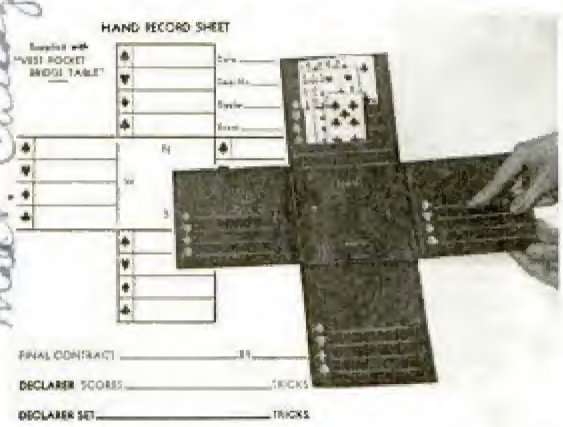
Fig. Marshall Co. 1944. S.D. m210

Plastic Cork on Pipes Stops Dripping

No. 1000 8 1/2 gal
Cold pipes, tanks or walls can be prevented from sweating and dripping by the application of plastic cork now available in gallon-size or larger cans. Spread on with a paint brush, whisk broom or sprayer, it can be used for covering surfaces such as metal, wood, concrete, brick, tile, cement and plaster, and it may be painted any color. Plastic cork makes a rough surface resembling stucco; it will not propagate fire, and is odorless and verminproof.

aa. May 1942 189 m-139

Pocket-Size Bridge "Table" Holds Dummy Hand in Slots



Folding bridge set, small enough to be carried in the coat pocket, forms tiny table top for players

Offering the facilities of a bridge table, a folding leather bridge set which can be carried in the coat pocket is handy for playing cards on a train, the lawn and other recreational spots where a table is not available. North, South, East and West players are designated in gold lettering on four sections which may rest on the players' knees. Each section is provided with slots marked in the four suits to hold the dummy hand, where the cards are clearly visible to all players.

Some fish which can change their color to resemble their background are unable to do this if they are blindfolded.

C.F. Rumpfs Sons 1523 Merchandise Mart Chicago

Better Version of a still life 205 8-11

It's steered like an automobile, and you pull the wheel back to climb, push it in for a glide. Notice the pilot's crossed legs. There are no rudder bars for the feet—only a brake pedal

IF YOU CAN DRIVE

By
Roderick M. Grant

PART I

THERE is no use being nonchalant about this. My stomach was tied up in a couple of granny knots and my spine was stiff as a new collar.

As casually as he'd have told me to come up to the blackboard and do an algebra problem, Bud Eddy, the Skyfarer's pilot, had said "All right, you take her up now."

We had been off the field, around the half-mile square and down the home stretch once, and now it was my turn at the control—I who had never sat in a cockpit before, never flown except as passenger in a transport plane. Air line travel, at least, had made me fearless of the third dimension, accustomed me to seeing cornfields and woodlots lying at a 45-degree slant under my left elbow. But then I had always depended on a veteran pilot who,

I was confident, was as anxious to come home unbroken as I.

"Cross your legs and forget you have any."

This plane was rudderless, and there was no work for feet until time to step on the brake pedal after landing. So I crossed them, but I was pushing them through the floor just as I "put on the brakes" when someone else is driving my automobile.

"Flaps down."

I fumbled around for the lever between us and pulled it into intermediate position.

"Throttle all the way in, now, and steer straight ahead."

Gripping the wheel like a life preserver, I did what I was told. We rolled down the

Pressing down on the tail of this light plane, you can lift the front wheel of the "tricycle" off the ground to turn the craft





Flaps half down, the "Skyfarer" climbs past the hangar. If you can drive an auto, you can fly this plane

see av. 1441-16
cinder lane, my eyes glued to the spot where the Skyfarer's nose bisected the runway.

"Back on the wheel, easy."

Very gingerly I pulled it toward me. The nose blotted out the cinders. We were climbing. This had happened to a lot of fellows before me, but now it was happening to me. We didn't seem to be traveling very fast, but it didn't occur to me to take my eyes off the nose and its up-tilt for a look at the air speed dial. We began drifting to the left.

"Keep her straight," said Eddy. "Make her do what you want her to do. Handle her as roughly as you like."

I gave the wheel a turn to the right, and incidentally pulled it toward me. We bit into the air at a steeper angle.

"Not so steep," Eddy cautioned, and I let the nose down, trying to

There's good visibility downward and on three sides. Here the author is watching for a clear runway before taxiing to the line



2929



G. Wayne Smith

Seaplanes are gaining popularity for sport. This is a pontooned Stinson

remember that this one little wheel, which was all I had to worry about at the moment, has two functions—steering and elevating. That was the first problem in three-dimensional coordination. I don't know what sort of acrobatics I'd have embarked on if both feet had been working, too.

Now if this were simply the story of some fellow's first flight, it wouldn't be a story at this advanced stage of aviation. It's more than that. It's the story of a dub who considers himself a good automobile driver, who has never been to ground school, who knows about ailerons what he reads in the papers, taking up and flying and bringing down a new sort of airplane that the government has certified is incapable of spinning. It has no rudders and it can't side slip. If I do the wrong thing, the Skyfarer, like a wise old horse, is likely to correct my mistake. If I flirt with stalling speed the plane will dip its nose, fall forward instead of backward or sideways, recover flying speed and level itself off. Right here,

100 feet in the air, sensitive to cross winds at the slow speed of the climb after takeoff, is a critical point in conventional aircraft but the Skyfarer took my ill-coordinated manipulations of the control without a whimper and climbed away.

Eddy told me to retract flaps and keep the nose up as the angle of attack changed and the leveling of flaps gave us an extra 10 miles an hour. At 600 feet I made the first turn.

"Keep the nose up," Eddy said, and I pulled the wheel back slightly,

watching the angle of nose and horizon instead of the golf course below. I remembered with a flash the first time I looked down from a steeply banked Ford Trimotor. This time there were no qualms at all; I felt as stable as in my favorite lounge chair. My mentor reminded me to anticipate the flight path, returning the wheel for level flight before the turn was completed. The next turn was a bit steep, but almost before Eddy warned me I was correcting it.

On the third leg I followed directions to level off at around 800 feet, cruising about 80 miles an hour. I still wanted to fight with the control, but I began to find it wasn't necessary. I took my hands off the wheel a moment and nothing happened. The plane knew more about flying than I. There was time now to look across at the airport from the big window of the comfortably heated cabin and feel sorry for the folks standing down there in the chill, damp wind and for the motorists fighting

Here is the "Skyfarer's" clean profile. Dotted lines show position of ailerons and front wheel in right turn



1929

Beginning ill. - Aviation Club
 Corp. Williamsport Pa

each other at the highway crossing. I wanted to go right on flying, but Bud Eddy pulled me together. We turned the third corner. Then he said: "Pull out the carburetor heat control. . . Now pull out the throttle."

I knew better than that. We were more than a thousand feet from the runway, and it looked like a mile. I pulled the throttle about two-thirds shut, knowing I would need some power to reach the field. But I couldn't fool the doctor.

"Close the throttle all the way,"

Checking oil before taking off. Notice the accessibility of the 75-horsepower engine



Engine very accessible - 75 hp

This is the low-winged Ercoupe, another spinproof plane

Eddy ordered. I gave it a quick shove—the wrong way. The engine revved up. Eddy pulled it for me.

"Forgot which way was off," I apologized.

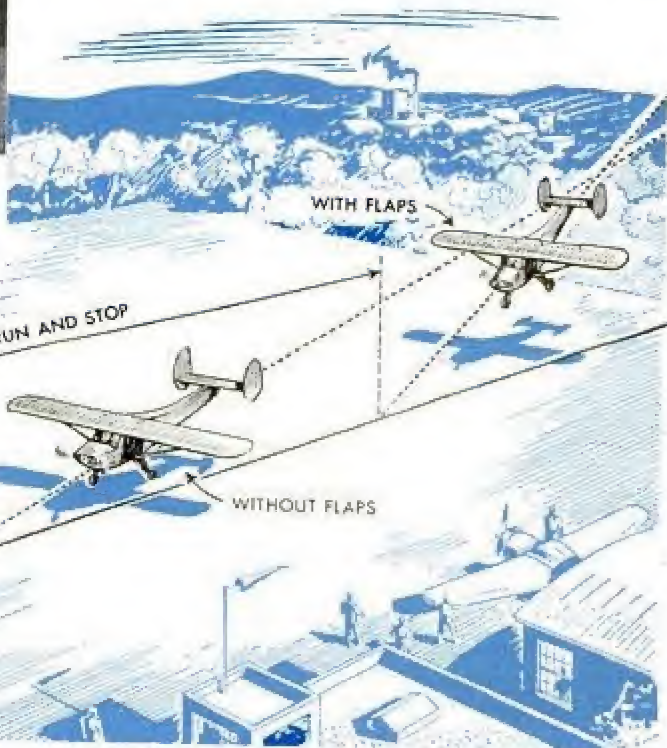
"Just like your automobile accelerator," he said, "push it in for speed." I remembered that next time.

We idled around the last corner, then I pointed the nose for the runway. Not steep enough. Too steep. Wobbling to the left. To the right. The flaps were down, the nose shoved forward to compensate for them. "Keep the air speed at 70

(Continued to page 166)



The drawing illustrates how the plane with flaps lowered can glide at a steeper angle and thus land safely in a smaller field



M 145.

Snap-On Screen Hangers Easy to Attach



Hanger snaps screen in place. Inset, left, hanger is flush with frame; right, hook protrudes slightly

Simple in construction and easy for anyone to install, a set of metal window-screen holders permits the screen to be hung from the inside without the old method of "fishing and hooking." There are two parts to the holder, one to fasten on the screen and the other at the top of the window frame, each taking two screws. To put it up, the screen is pressed at a slight angle against the top of the frame and then given a hard push, thus snapping it into place. The screen may be opened at any time by swinging it outward. The holder may be installed in two ways: first, as a double hook, and second, it may be inverted and the woodwork routed so the holder will not interfere with stacking the screens.

M 246

Delayed Jump of Steel to Magnet Shows Change in Structure

In delaying its jump to a magnet, a strip of steel reveals a delayed change in its atomic arrangement. The metal, known as 18-8, is stainless steel containing 18 percent chromium, 8 percent nickel and the rest iron. This metal is not ordinarily attracted by a magnet because it usually

Scheuchlady, N.Y.

contains a little nitrogen. However, if a piece of nitrogen-free metal is heated to 1,100° Fahrenheit, and then cooled, the magnet phase returns when it is down to boiling point of water. In recent experiments, Dr. Herbert H. Uhlig of General Electric research laboratory, found that if the heated strip is cooled suddenly by quenching in water, it is not immediately attracted to the magnet, but after about a minute and a half it suddenly jumps toward it. To explain this it is pointed out that, although the atoms start rearranging themselves as soon as the strip is cooled, it takes about 90 seconds for a majority to shift, and at least a day passes before all reach a state of equilibrium. Research into this change in the crystalline structure of the metal is expected to reveal more about heat treatment of steels and lead to the production of alloys with better mechanical properties and resistance to corrosion.

M 166

Flower Pot Holds Ant Poison Concealed in Its Base

Everlasting artificial flowers bloom in a small decorative pot whose real function is to kill ants. Hidden in the bottom is a special ant paste, sealed off so children and animals cannot touch it. Four tiny notches in the base permit ants to reach the poison.



Slots permit ants to reach poison concealed in base

73 10. *Comp. J. Leland Blain*
3822 - Miller Way
Sacramento
Calif

Women's Fire Brigade Trains for War Duties



near Sacramento
 Even before the war brought its new dangers to California, the women of Citrus Heights, an urban area near Sacramento, joined up to form a volunteer fire brigade. Already they've fought flaming gasoline truck and automobile fires, prairie and home fires. They'll take on anything—bombs included. Above, at left, they practice carrying hose into a building; at right, they learn how to handle a fire ladder

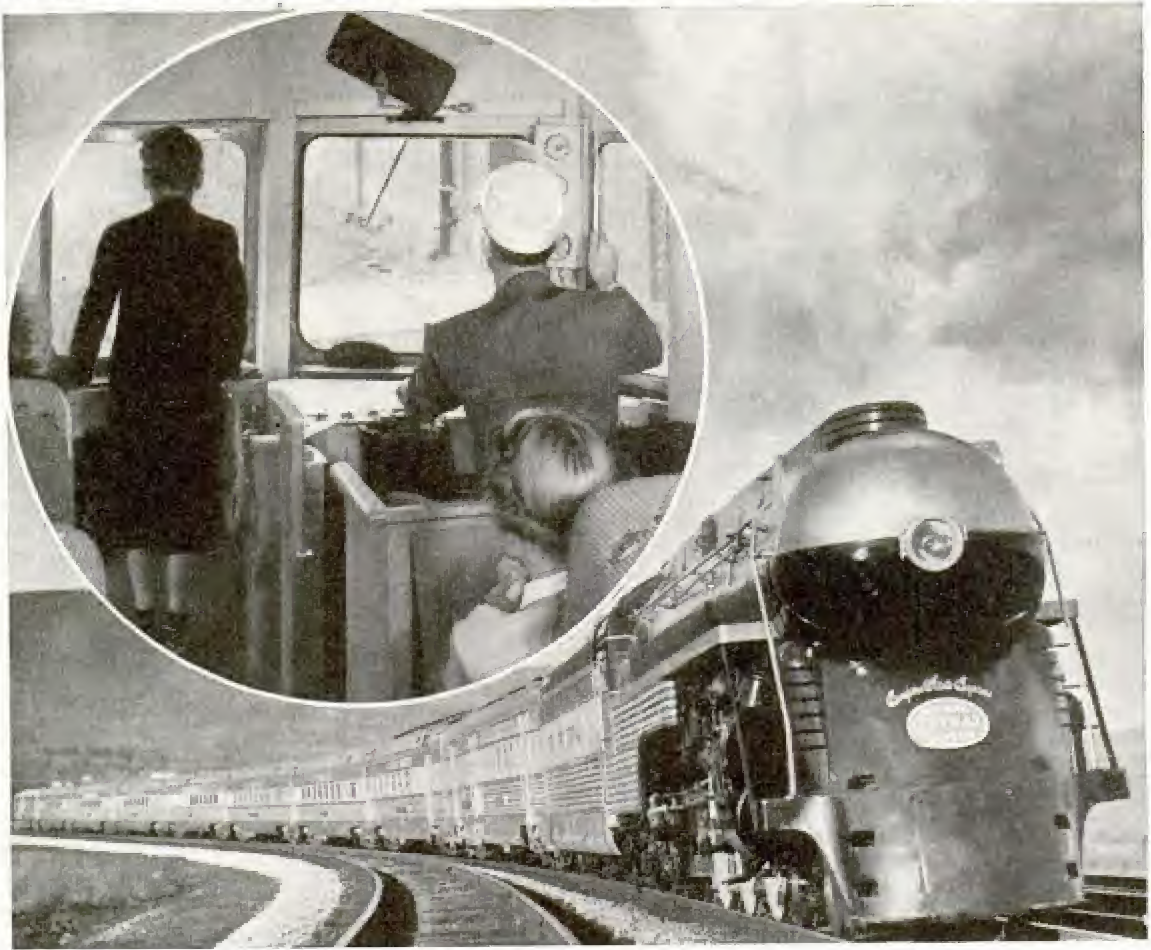


Citrus Heights has three fire trucks, and the women "man" them. They're trained to handle all the equipment (above) just as the men of the volunteer brigade do; most of the men work in nearby cities. At right, the ladies put in some practice with the hoses. For nearly two years they have engaged in weekly drills and monthly reviews of fire fighting technique, which means everything from starting the trucks to rescuing persons from buildings and giving first aid

m 134

L. Grant

The LATEST in STREAMLINERS



The era of streamline trains is not ten years old, yet today more than 130 streamliners are plying across all but a half dozen states and a score of new trains are being built. American railroads operate 75,000 miles daily of mile-a-minute passenger trains. Travelers take to them in swarms; last year the total of passenger-miles was 22 percent over 1940. This year war business and tire saving are adding to railway travel. One of the newest streamliners is the steam-driven, stainless steel "Empire State Express" of the New York Central, shown above. It offers coach passengers the luxuries of adjustable, sponge-rubber cushions and lounge-observation cars decorated with historic murals. In the circle, above, the operator and passengers look out the forward windows of the "Land o' Corn," a two-car streamliner on the Illinois Central railroad. It is driven by a 225-horsepower Hestelman engine, oil-burning like the Diesel but with spark ignition. It starts with hydraulic drive, then shifts automatically to mechanical drive, reaching top speed of about 83 miles an hour. At left, a traveler in dining car of the Pennsylvania's "Broadway Limited" chats by phone with a friend in the observation car

21734.



Wood veneer walls and fluorescent lighting add to the attractiveness of the "Empire State Express." The two new trains, which cost \$2,500,000, have disk-type brakes, and the trucks are insulated from the car bodies by composition molded parts to prevent transmission of the track noise



Left, the "South Wind" roars around a curve on the Louisville & Nashville, bound from Chicago for Florida. Three roads cooperated in starting streamline high-speed coach service daily between Chicago and Miami, and it proved so popular that seats were sold out a week or more in advance

The "Columbian," coach streamliner on the Baltimore & Ohio between Chicago and Washington, is wired for sound. From transmitters in diner and observation cars the stewardess describes historic and scenic spots, and here the dining car steward is calling a passenger who has reserved a table



↑
Something really new under the railway sun is the pendulum car. There are three of them, built for The Santa Fe, Great Northern and Burlington. Riding on huge coil and leaf springs (above) the body is suspended from above its center of gravity and banks itself like an airplane when it rounds a curve



JUNE, 1942 see Jan. 1941 P. 2.

Luminous Strip on Shoe Sole Glows Visibly in Blackout



Luminous soles and heels make shoes glow in the dark

Shoes given a luminiscent treatment around the edges of the soles are now offered for use of air-raid wardens, policemen and others whose work or civilian defense activities keep them out at night when there may be a blackout. Five different coatings, starting with a white base, are applied to the soles and heels to make them luminous.

Sun's Technique of Keeping Hot Is Copied in Atom Smashers

For a billion and a half years the sun has been burning up energy and restoring itself, and—cheer up!—it probably will stay in business for another 10 billion years. It really is a big atom smasher, feeding on atomic energy by transmuting hydrogen into helium, with carbon acting as a go-between. Dr. H. A. Bethe, physicist at Cornell University, reports that scientists have worked out in their own atom smashers the six-step process by which the sun maintains its enormous output of energy. The process takes 5,000,000 years on the sun. A carbon nucleus picks up a hydro-

gen nucleus and is transformed into nitrogen, which disintegrates into another form of carbon. This picks up an additional hydrogen nucleus, and they turn into another form of nitrogen, which thereupon picks up a hydrogen nucleus and becomes oxygen. The oxygen disintegrates into a third variety of nitrogen, which is completely smashed by a hard-hitting hydrogen nucleus. From the fragments, two new elements are formed—helium and the original carbon. Thus, after 5,000,000 years, four hydrogen nuclei—the fuel of the solar fires—have been consumed but the original carbon, and the helium ash, remain.

Book Cover Fitting Many Sizes Applied Without Cutting

Adjustable to fit books up to 15 inches, a ready-made covering easy to apply is folded over like the ordinary paper cover and held in place with elastic tapes and hooks. No cutting or pasting is required. The flexible cover is folded evenly to book size, one book cover inserted into the fold and the elastic tapes drawn across each other, hooking at top and bottom. Then after wrapping the folded cover around the book and repeating the original performance for the second book cover, a few minor adjustments will give it the correct proportions. Made in various colors, the covers are interchangeable and provide long-lasting protection.



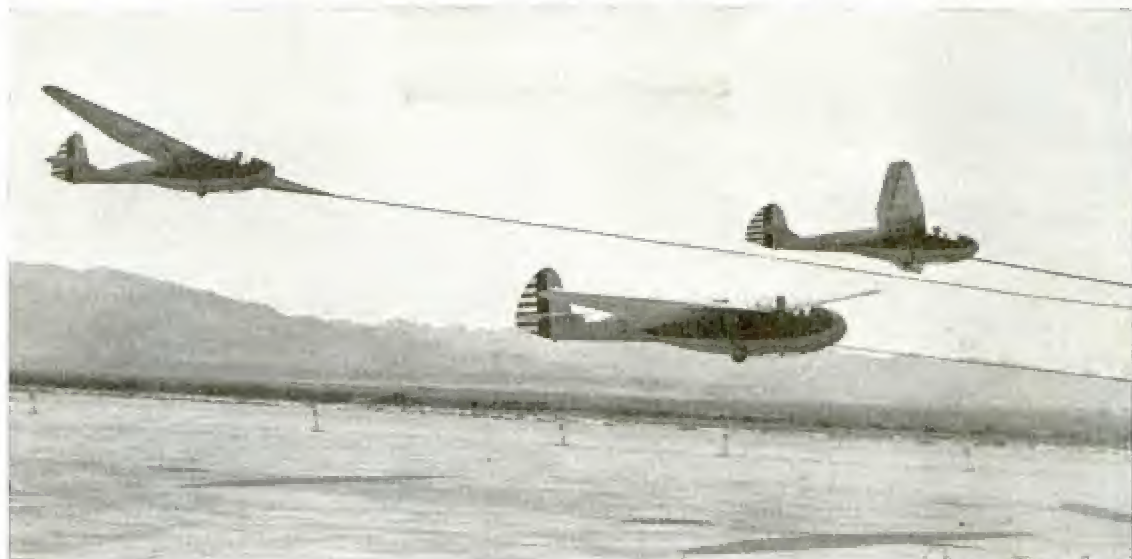
Cover folds about books and hooks on by elastic tape

POPULAR MECHANICS

The Price Co.
114 W. 27th St. New York

m 198.

Three Gliders Towed at Once by Army Plane



Three gliders attached by ropes to one army plane; two fly abreast and third one follows far behind

Pilots at the ^{California} West Coast Air Corps Gliding School can launch and tow as many as three gliders at a time, using one airplane equipped with a 295-horsepower engine. At an altitude of about 3,000 feet, the gliders may be cut loose from the tow lines to soar on their own, the length of soaring time depending on the thermal conditions

of the air. Gliders can be towed in units of one, two or three. A single tow is made with a rope about 400 feet long. Double tow requires two ropes forming a "Y," one glider flying slightly back of the other. In towing three gliders at the same time, a longer line is used for the craft in the middle and two shorter ones on either side.

Scale Weighs a Film of Tarnish 10 Billionths-Inch Thick

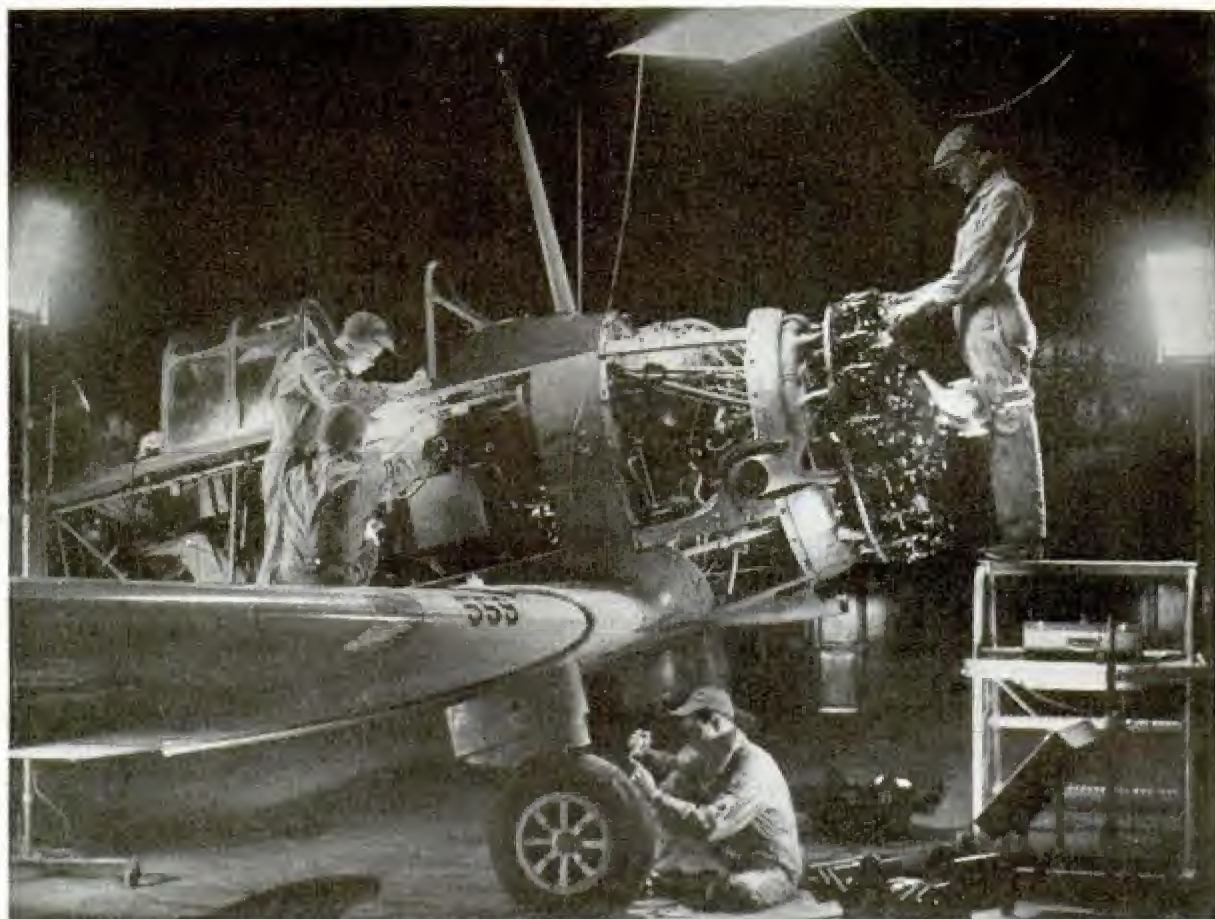
On the trail of an invisible saboteur—oxygen—which attacks metals with rust and corrosion, scientists at Westinghouse research laboratories have built a scale that weighs unseen tarnish films about 10 billionths of an inch thick weighing 15 billionths of an ounce. The scale is so sensitive it indicates loads in weight units of 10 billionths of an ounce, and movements of the pointer are so minute they can be seen only through a microscope. The balance is housed within a glass tube in the shape of a cross. A tiny piece of steel is used in the test, and after all tarnish has been removed from the sample, small amounts of oxygen are admitted into the sealed tube. As the oxygen combines with the surface layers of the steel, the sample becomes heavier and its gain in weight is recorded every few minutes. The experiments are expected to reveal such things as what makes stainless steel stainless, which it is hoped may lead to some simple way of giving other metals the same protection against oxygen in the air.



Reading the weight, top, and size of sample tested

KEEPING OUR WARBIRDS

Randolph Field



Night and day, under artificial light and sunlight, mechanics keep busy taking down and reassembling engines of fighting and training planes

And here two of the specialists test the landing gear of a big plane. Pilots' lives are precious and nothing can be permitted to go wrong

Curless A-18



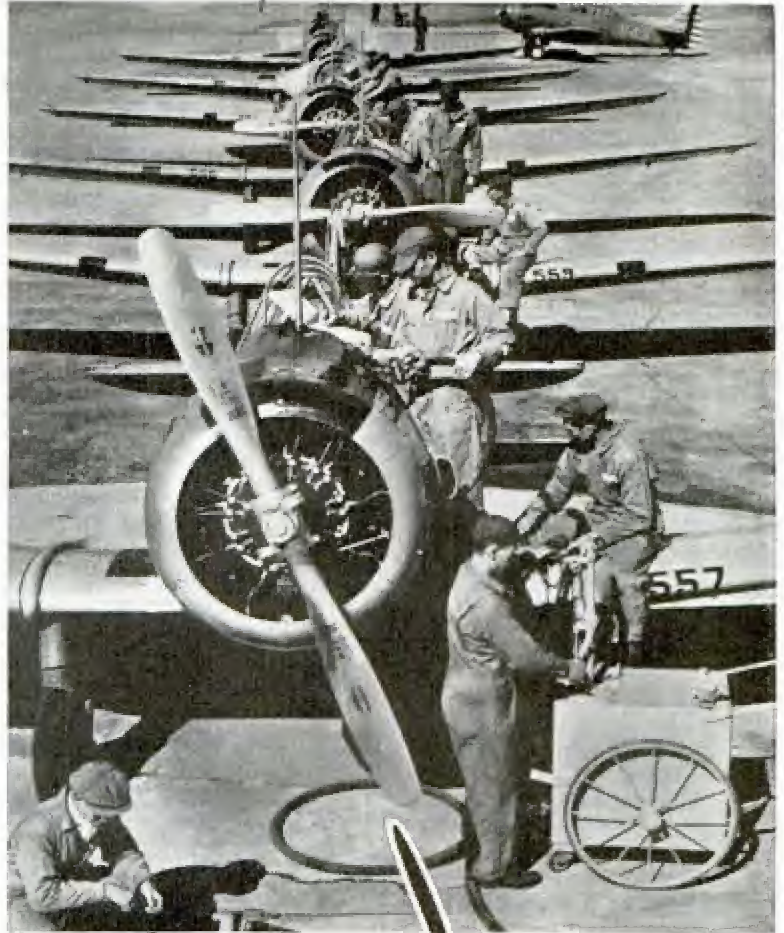
BACK of America's fighting men of the air, and largely responsible for their success or failure in combat, are thousands upon thousands of specialists—the maintenance men of the Army and Navy air units. Their job is to keep our military planes in flying and fighting condition.

Beside the expert mechanics, to whom falls the task of repairing, overhauling and tuning the engines to the rhythm of victory, there are men who specialize in radio work, bomb loading, machine gun and cannon maintenance, landing gear, propellers, patching of wings and fuselage damaged by enemy fire, refueling and numerous other jobs essen-

FLYING

tial to effective operation of a mighty air force. Then, too, there are other thousands of men who keep a constant stream of supplies—gasoline and oil, ammunition and bombs, spare engines, replacement parts and many other items—moving to each unit. Their number is legion, of course, for it takes from eight to ten on the ground to every man in the air. When the United States Army Air Forces reach the projected strength of 2,000,000 men, there will be some 500,000 mechanics among the more than 1,500,000 members of the ground personnel.

In order to provide efficiency in operations of this kind, the Air Service Command was created a few months ago, with its headquarters at Wright Field, Dayton, Ohio. Its duties are to supply, maintain and store materiel and equipment and to provide essential services for the Army Air

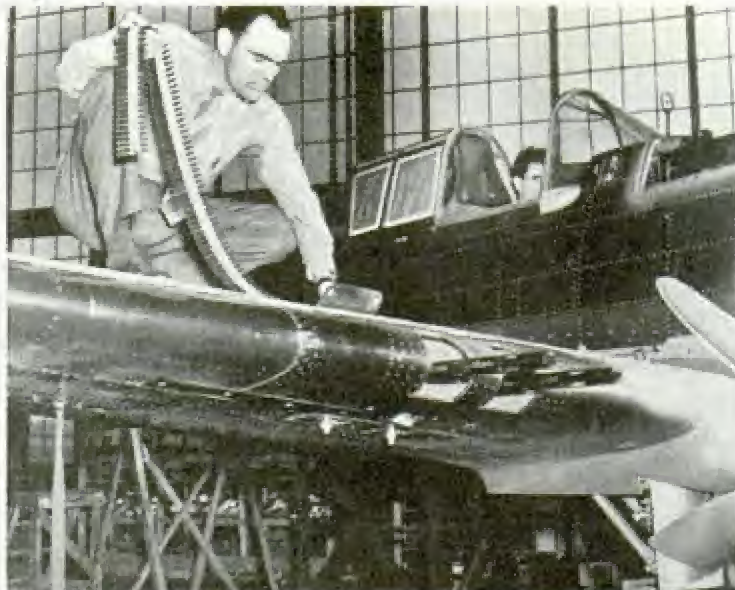


↑
This is a typical ground operation, with the specialists grooming a line of airplanes

↓
A sign that our pilots mean business—loading machine guns and cannon in a Bell Airacobra



1398



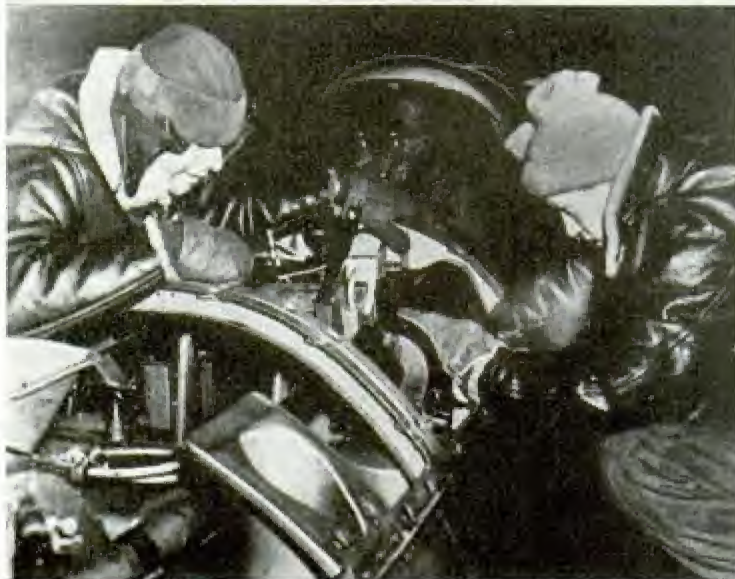
↑
Loading ammunition into the machine guns with which the Curtiss P-40 is armed

Warner

→
Preparing to install a machine gun in a Curtiss; soon the plane will be ready



Ladd Field, Fairbanks, Alaska



Forces, the Air Force Combat Command and the Air Corps. This means keeping every bombing plane, pursuit ship, observation plane and trainer—in fact, every plane in the Army Air Forces—ready to fly and ready to fight.

Major General Henry J. F. Miller is in command of this important organization, which re-

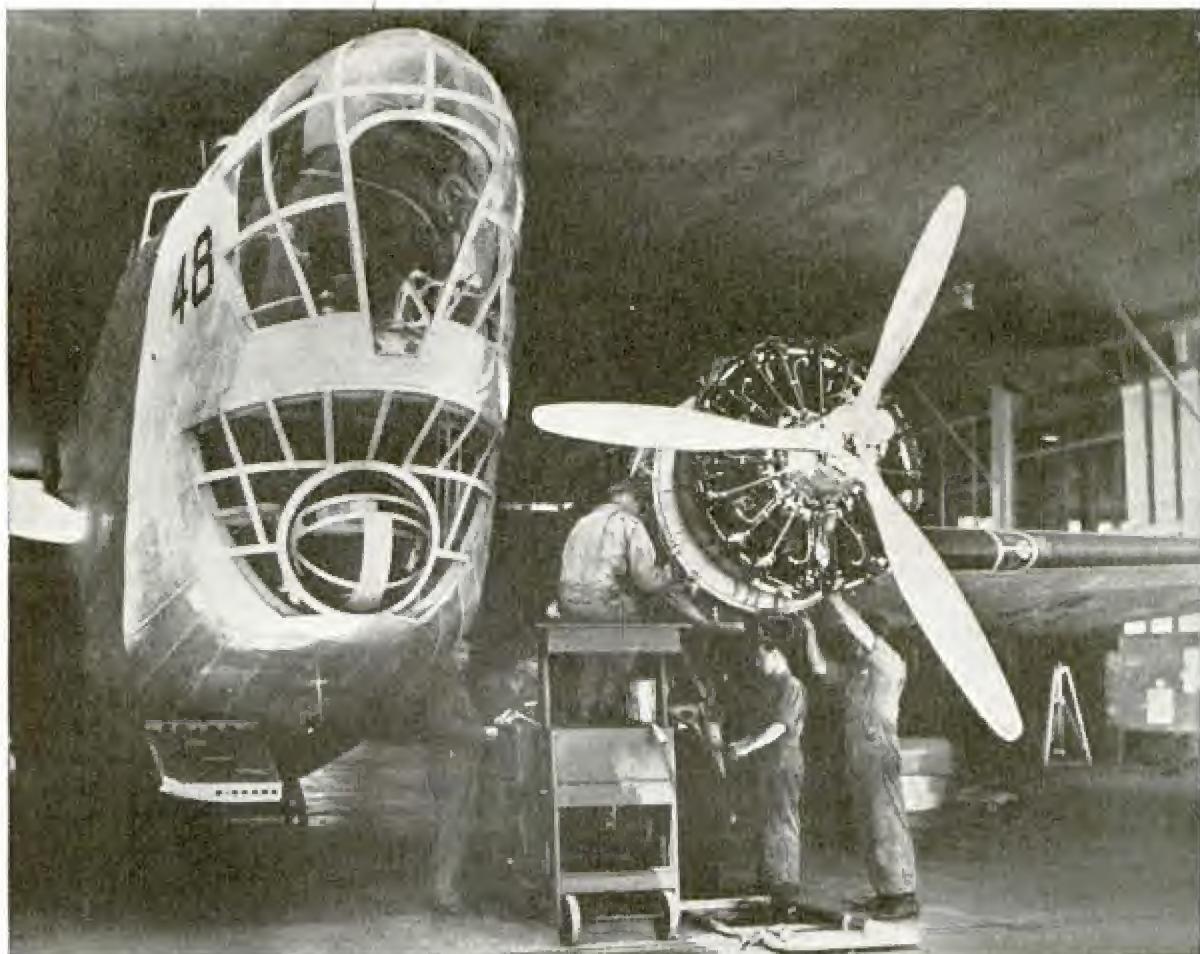
places the Maintenance Command, a former unit of the Air Corps Materiel Division. Since the Materiel Division has been concerned primarily with experimental work and procurement of new aircraft, it became apparent, with the continuing expansion of the Air Forces, that a separate supply and maintenance organization was required.

The Air Service Command

In every kind of weather—even the Arctic—our mechanics are grooming our warplanes

POPULAR MECHANICS

21397



Douglas B-18 (9)

is charged specifically with supply, maintenance, warehousing and air transport between stations and is responsible for the adequate stocking, proper cataloging and rapid distribution of equipment and supplies. To facilitate this tremendous job, and daily growing greater because of the new program providing for the world's greatest air force, the country was divided into four areas, with headquarters established at Hempstead, N. Y., Spokane, Wash., Tampa, Fla., and San Francisco, Calif., each under the Command headquarters at Wright Field. Further expansion may come later.

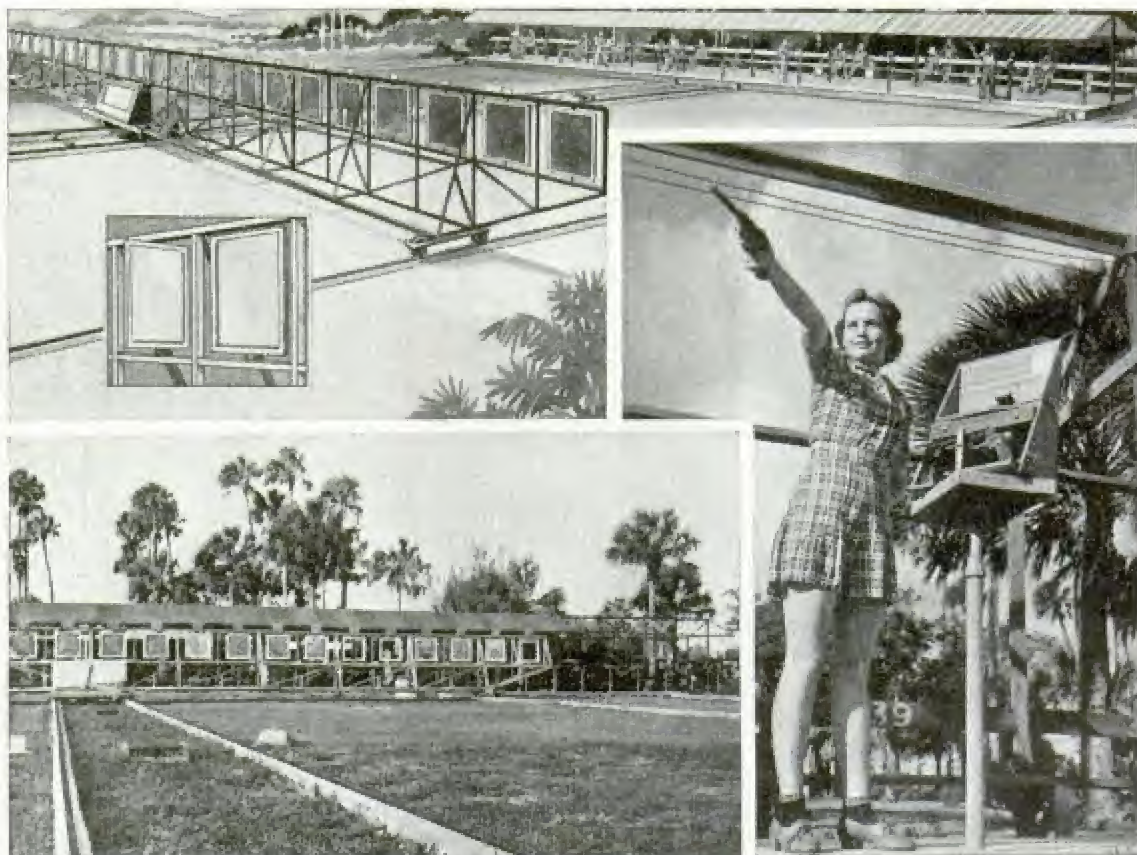
To make U. S. bombing planes more effective, ground men, above, go over them carefully

It takes well-trained men for the job shown below, too; loading bombs into the plane's rack

Curtiss A-18



"Walking" Range Improves Marksmen's Aim



Drawing and photo show pistol range on wheels and swivel targets; right, one of the club's experts takes aim

So effective has a "walking" pistol range at a Miami, Fla., club proved, that the U. S. Marine Corps plans to build similar ranges to train its sharpshooters. Forty targets are mounted on a 2½ ton traveling crane 160 feet long. The targets advance from the rear of the range, 50 yards away, right to the firing line. A five-horsepower electric motor operates the crane. Another novel

feature is an "edging" arrangement operated by a compressed air cylinder. Only the edge of the target faces the firing line before a match begins; then at the touch of a pushbutton all 40 targets swing synchronously in a split second to face the marksmen. This acts as a foolproof signal in rapid-firing contests and trains the marksman to be steady and quick on the trigger.

Hearing Tester Cuts Off Sound to Detect Attempt to Cheat



Sound cut-off switch assures honest test of hearing

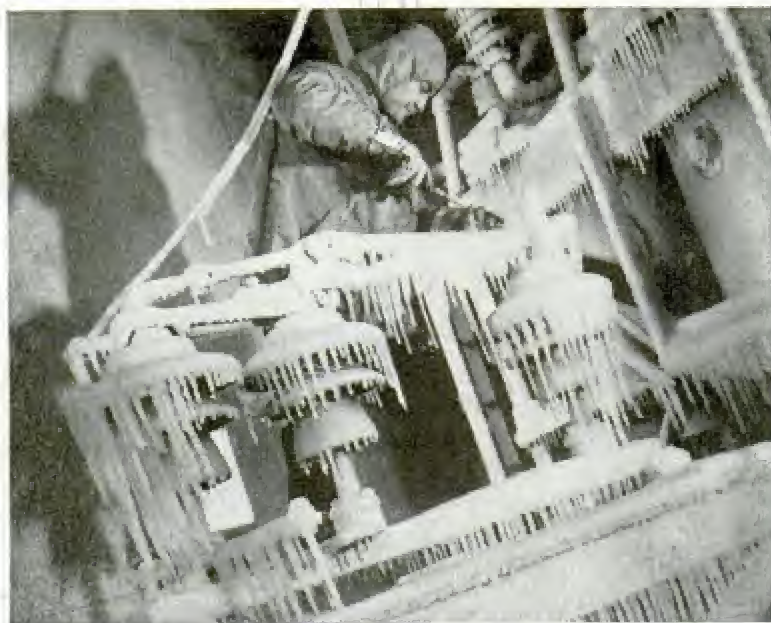
Former methods of testing hearing with the tuning fork, the dropped coin and the voice are being replaced by an audiometer now used by airlines. It is more accurate and speedier, and leaves little chance for outwitting the operator. Operating electrically as a calibrated audio-oscillator, the instrument produces sustained tones of precise frequencies and in measured decibels of intensity. Tones range from a low pitch of 64 cycles, to a high of 11,584 cycles. In a test the volume is adjusted to a point barely audible to the listener, and, starting with the lowest tone, the operator raises

the pitch through each successive frequency. If the listener fails to hear a tone, he presses the signal button. The operator then increases the volume to a point where the tone may be heard. A silent interrupter switch can cut off the tone at any time, thus exposing any attempt to claim better hearing than actually exists. A complete record is kept of every test showing the listener's ability to hear in each frequency.

Match Books Embossed With Ink and Powder

Anyone can emboss his own name on specially treated match packs by using a certain kind of powder, ink and pen. With the pen and ink, the name is first written on the match pack. Then the powder is dusted onto the ink, which become fused onto the flap when held over a 60-watt electric light bulb. The result is a signature in unique raised letters. To prevent burning the fingers or igniting the matches, an asbestos holder is supplied to slip over the matches when they are held over the light bulb.



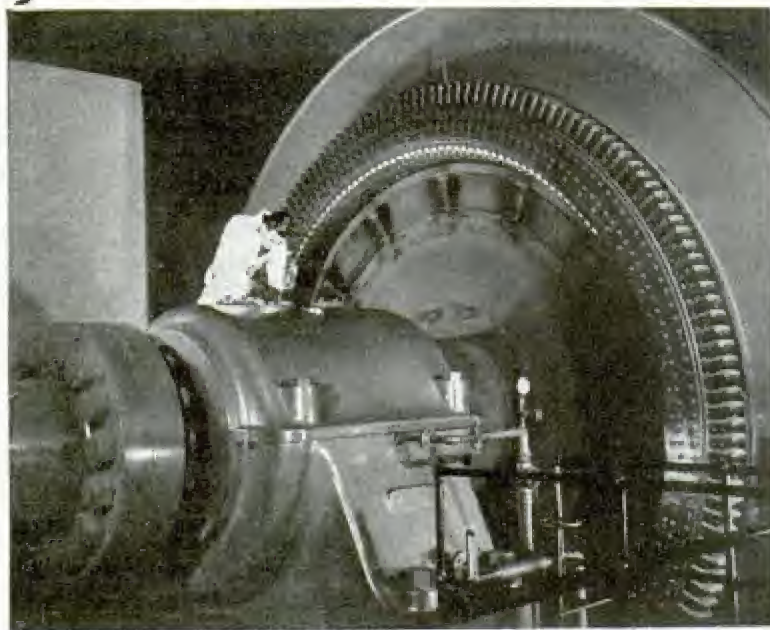


Power-line switch being prepared for test in 20-below-zero laboratory

station by a saboteur, the severance of a power line so it would fall to the ground, explosives planted on the ground or an aerial bomb might be the means of creating such short circuits.

These hard-hitting test charges, amounting to 2,000,000 kilowatts, carry twice as much power as is produced at any instant at Niagara Falls. They are created by twin, 500-ton generators in the laboratory, located at the Westinghouse East Pittsburgh works. Each generator is driven by a 6,000-horse-power motor. If the generators could deliver continuously their com-

TORTURE CHAMBER *Guards* POWER LINES



Checking oil in bearing of a 500-ton generator in test laboratory

Bank of 15-foot transformers in Westinghouse high-voltage yard



ELECTRICAL knockout punches—equal in destructive force to 75,000 lightning bolts—are being hurled in a new high-power laboratory that will play an important role in the protection of America's power lines against bomb and sabotage damage.

Safety fuses and circuit breakers, the guardians of power lines, are tested in this laboratory to determine their resistance to tremendous surges of electricity caused by short circuits. A bar of steel thrown across the electric circuits in a power



Electrician (at left) using wooden pole to close knife switch while man at right receives instructions for setting the switches



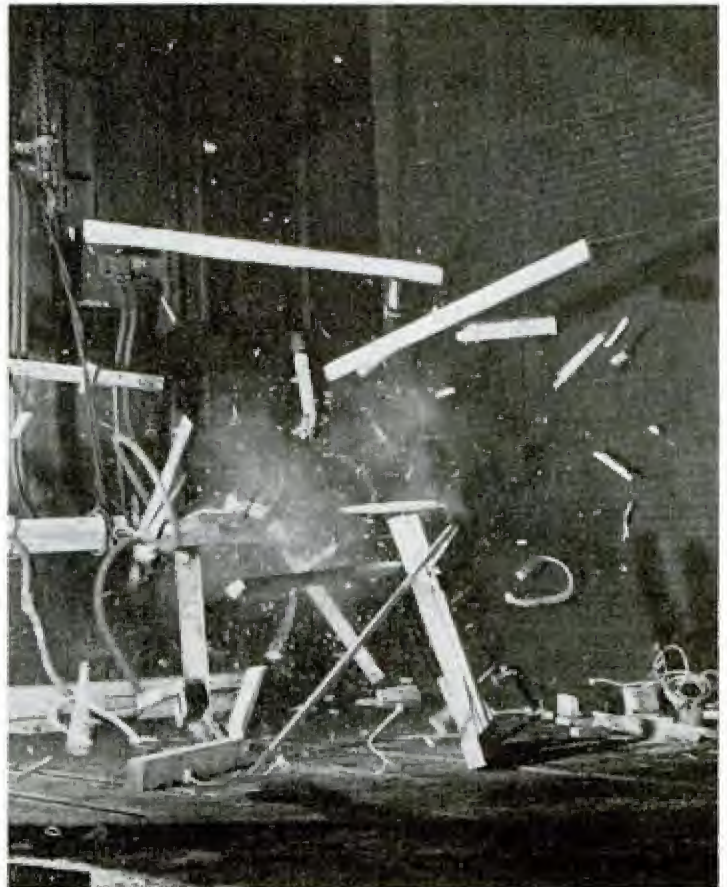
Engineer in control room of laboratory has at his fingertips 150 knobs, buttons and dials to regulate power creation and flow

bined output, the 2,000,000 kilowatts would light enough tube-shaped fluorescent lamps to girdle the earth twice at the equator. The mechanical equivalent of that much electricity is 2,680,000 horsepower—enough to drive 20 modern battleships.

Spinning at their top speed of 514 revolutions per minute, the generators' two 300-ton rotating members, called rotors, when short-circuited set up vibrations that shake the gymnasium-sized brick and steel laboratory building. Release of a short circuit surge from the machines drains electricity so suddenly from their copper windings that the entire mass of the two generators recoils like a gun and only special steel spring mountings

(Continued to page 174)

Explosive force of 1,500,000 kilowatts of power pulls apart three copper cables sandwiched between six-inch timbers bound with heavy rope



Emb. Jane White, 418-19th Ave. San Francisco Calif

m 90.

Tile Mural Built With Watchmaking Precision

Arline Lodge



Peggy Ford



Top, right, finished mural on building; left, glazing head-hunter's shield; bottom, laying a tile

Hairline precision in forming the tiles for a mural erected over the entrance to the National Broadcasting Company's new building in San Francisco required new manufacturing methods and extreme care in selection of colors. Made up of 2,560 tiles, each six inches square and formed to an accuracy of 1/13,000 inch, this mural stands 40 feet high and 16 feet wide. The tiles consist of a mixture of flour-fine talc, silica and clay treated and molded in heavy

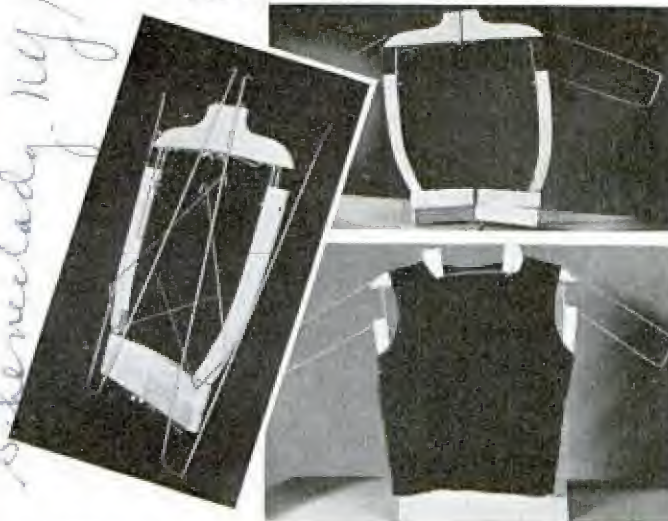
presses under a pressure of 1,000 pounds per square inch. They were then baked at a temperature of 2,150 degrees, Fahrenheit, thermostats being used to maintain a uniform kiln temperature throughout. After baking, the white tiles, or "bisques," were tested for warps or cracks that might occur in burning, and were checked for size with micrometer precision. To prepare them for coloring, several rows of the white bisques were laid out, constituting one section of

the mural, and the working drawing for that section was placed over it. Then lines were traced onto the tiles through carbon paper to form divisions between adjoining colors, or "glazes." Each color zone bore a number corresponding to one of the 114 colors in the original oil painting. The glazes, contained in small rubber syringes, were "flowed in" and the sections were returned to the kiln for baking up to 2,000 degrees. After the tiles were pieced together in the mural, it was discovered that the rich, high-fired colored glazes were more brilliant than the colors in the original, and they are said to be capable of holding true under all kinds of weather.

Sweater Drying Stretcher Adjusts for Many Sizes

Fully adjustable in both length and width, a sweater stretcher holds garments in shape while drying. Made of wood with sliding metal strips that provide the extension feature, the blocking frame may be enlarged from size 32 to 44. The top and bottom pieces are split in the center and joined by the metal pieces for sidewise adjustment. The sides are similarly joined at the shoulder to permit adjustment in length. Wire sleeve holders, supplied in two sizes, fit into the frame.

Mueller



Frame is adjustable in all directions to fit size of garment

M.I.O.

Slotted Hoods for Auto Lights Slip Over Lenses in Blackout



Top, fitting blackout hoods over the headlamps. These slip on easily without special attachments. Below, the taillight mask

Metal shields that are easily installed over the automobile lights during a blackout are offered by a Chicago inventor in shapes and sizes to fit most recent car models. The hoods are slotted to throw a beam of light visible 100 yards ahead, but visors and baffles prevent any light from shining upward or against the ground, where it would be reflected and become visible to an airplane observer. In a test made with the blackout shields on a city street, no light was visible from the 19th floor of a building. The set of hoods, available in a protective metal box, includes coverings for headlamps, tail lamp and the rear license light.

*Chicago Curtain Stretcher Co
3727 N. May St. Chicago*

*(Mueller's Patent. Frame Co.)
Sweeney, N.Y.*

Chicago Dancer #01 of 17th Ave

The REVOLUTION in FARMING

FEWER people than live in New York City some day may be able to raise enough food to feed the whole United States.

This startling conclusion is based on the rapid strides that agriculture is taking. In Revolutionary times more than 75 percent of the population worked on farms. By 1910 only a third of the people were farmers and today less than 25 percent of the population cultivates the soil. Of these, 50 percent account for about 90 percent of production. The trend toward greater production is still accelerating and some economists figure that within three years the average farm will be able to produce 30 to 40 percent more than it could back in 1930.

This is coming to pass



↑
Comparing plants, the smaller ones of which were fed nutrient solution deficient in a vital element



↑
Water curtain on glass roof admits sunlight to growing plants but excludes heat

Tanks and covers, interiors painted → black, used in water culture



because of improvements in the quantities and qualities of farm products, more accurate anticipation of weather conditions, better pest control, better plant feeding, and more complete mechanization of farm operations. The result is that farmers are raising more food of better quality with less effort than was ever imagined. The United States, with only two percent of the world's farm population, is the world's greatest agricultural nation.

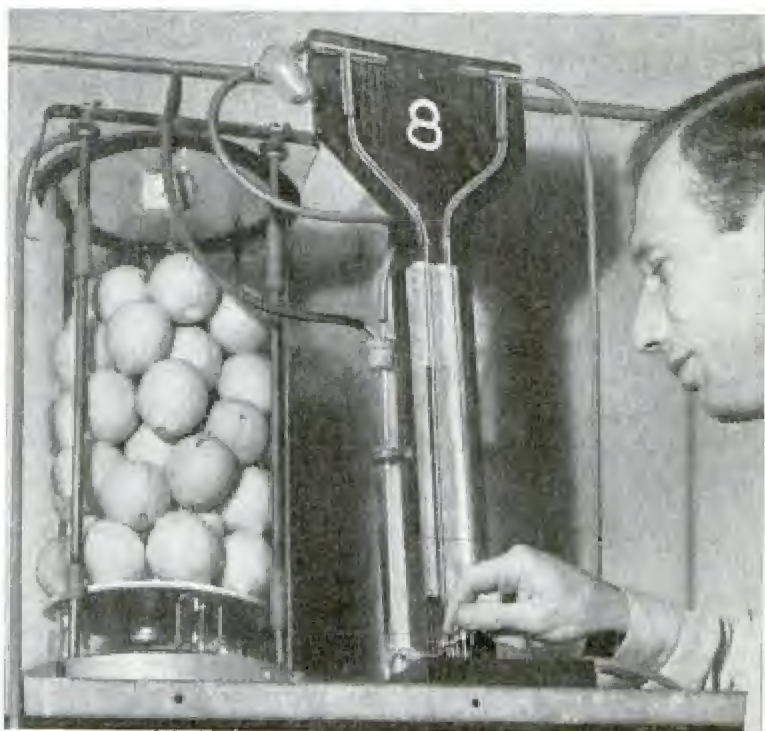
Hybrid corn is an outstanding example of what is happening in plant breeding but it is not the only example. Hybrid corn yields 20 percent more per acre and is also more resistant to diseases, drought and wind, with the result that production per acre is really doubled. A new strain of oats developed in Wisconsin is just as remarkable, yielding 80 bushels per acre instead of 40, and having other desirable qualities. Other grains, fruits, and vegetables are being improved similarly.

Now that science is learning to foretell general weather conditions four and six months in advance, farmers are going to be able to advance or hold back their plantings to take advantage of the weather. One way to help get a crop no matter what the early weather is like is provided by a new variable depth cotton planter. Some of the seeds are planted shallow, some are planted deep. If the seeds from both depths grow the poorest can be hoed out. But if frost kills the upper sprouts, the deeply plant-



Apparatus which makes possible the determination of effect of various light spectra on plants; note the fluorescent light tubes

Measuring amounts of gas given off by fruit in storage; this is part of the program to reduce spoilage in large storehouses





Sealed chamber inside of which elements required by cow will be studied

seems to be for the raising of a few such specialty crops as out of season tomatoes and hot house flowers.

Water culture may never revolutionize farming directly but it is more than doing its part in helping change agriculture into an exact science. It is the best tool research men have for studying the food that plants require. When soil deficiencies can be satisfied, crops will be of a more uniform high quality, of higher vitamin and mineral content, and more resistant to deficiency diseases. In some cases selective feeding controls and even alters some plant characteristics. Water culture is the favored method for such investigations. The complex minerals in soil used in experimental



Machine that gathers and chops guayule plants preparatory to rubber extraction process

Copyright 1941 Automobile Club of Southern California

ed seeds will still grow. If wet weather rots the deeper seeds the same weather makes the shallow seeds flourish.

Some people have hoped that the labor of growing food could be cut to a minimum by "factory farming," using the hydroponics or water culture method of raising plants in solutions that contain all the minerals needed. Great things were promised for hydroponics four or five years ago but now water culture has settled back into its old role of being an important research tool. Commercially, its only practical value

plots can't be controlled or even measured, while with water culture the exact amount of minerals fed to the plants is known.

Even so, the research men have their problems. Some of the zinc contained in rubber tubing, for example, is apt to contaminate the mineral solution as it flows through the tube, completely changing the proportions in the solution.

For healthy growth, plants must be pro-

21390
vided with such elements as nitrogen, potassium, phosphorus, and calcium. In addition they need tiny quantities of copper, boron, zinc, molybdenum, and manganese. Usually soils contain greater quantities of these micro-nutrients than the plants can use but sometimes the plants show signs of illness in spite of the plentiful mineral supply. Apparently some of the chemicals are in a state that can't be absorbed by the plants.

Many obscure plant diseases are now known to be caused by such lacks. Such deficiencies limit production. Little-leaf in fruit trees, it has been found, is caused by a lack of zinc and today trees are sprayed with a zinc solution to combat the condition. Corky tissue in apples results when the trees grow in soil lacking boron. Spreading a few pounds of borax in the soil around the trees improves the crop. Manganese salts are injected into walnut, orange, and lemon trees when lack of manganese in the soil retards them.

Today plant scientists are trying to learn how the minerals in a soil move into a

Examining two-year-old pear tree raised by water culture at Berkeley



Using Geiger counter to locate radio-active food fed to tomato plant

plant and through it from one part to another. From this they hope to be able to increase soil fertility when needed, either by adding needed chemicals or by adding material to the soil that will release some of the chemicals already present.

To trace the movement of food into and through a plant they are using elements that have been made radio-active in a cyclotron. On the Berkeley campus of the University of California, for instance, eight or ten elements including bromine, rubidium, zinc, and phosphorus, are being used in the radio-active studies. One of these radio-active elements is added to the nutrient solution and a Geiger counter that indicates radio-activity is used to determine how long it takes the plant to absorb the tracer material. In some cases the plant is dissected and each part is measured for radio-activity. In other cases "radio autographs" that show the distribution of the material through the plant structure are made with X-ray film.

The absorption of nitrogen, carbon and hydrogen by plants and the movement of these elements through the plant is achieved by adding heavy isotopes of such elements to the nutrient solution. These tagged atoms are later detected in the plant by using a mass spectrometer that sorts the heavy isotopes from the normal ones. Complicated as such studies are, these are only a few of the investigations that are being conducted to improve agriculture.

(Continued to page 175)

Crocheted 'Hammock' Sling Supports Arm in Comfort



"Hammock" sling gives arm a comfortable support

Made of cotton yarn crocheted in a wide mesh, a new arm sling shaped like a hammock has been developed for the British armed forces by Miss Marjorie Bate, a member of St. John's Ambulance. Said to give better and more evenly distributed support to an injured arm, the sling also does away with knots and pins.

Meter Reveals Velocity of Air Flowing Through Ducts

Better control of air velocity in heating systems and air-conditioning units is ob-

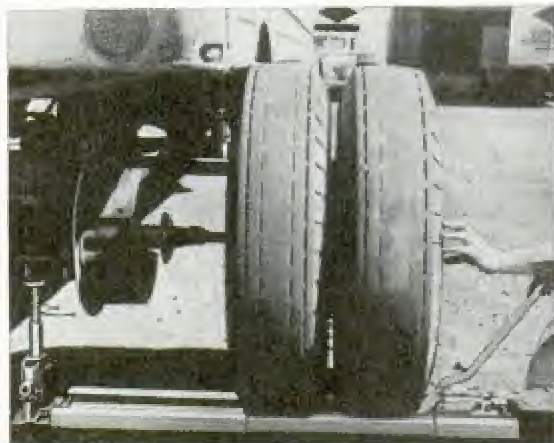


Meter shows speed of air leaving or entering duct

tainable with the aid of a direct-reading meter that indicates the speed of air in feet per minute without the use of a separate timing device or the need of calculations. Fitted with a special attachment for taking readings at intake and exhaust grilles, the instrument enables the operator to balance the incoming heated air with the outgoing stale air. By changing the jets, it is also possible to take readings of velocity and pressure in air conditioning ducts, paint spraying booths and wind tunnels.

One-Man Truck Wheel Remover Saves Labor of Lifting

One mechanic can remove or replace quickly the heaviest single or dual wheels with the aid of a truck wheel remover that bears the entire weight. With the truck jacked up, the remover is slid under the wheel to be taken off. Then the truck is lowered enough to allow only the weight of the wheel to rest on the platform of the remover. A few easy strokes of the handle



Heavy single or dual truck wheels can be removed or replaced by one man with this sliding platform

move the platform outward until it has carried the wheel completely clear of the truck axle. To replace a wheel, the operator reverses the ratchet, pumps the handle and slips the wheel onto the axle without manual lifting.

TRY THE WHERE-TO-BUY-IT INDEX

Names and addresses of manufacturers or distributors of commercially available products described in Popular Mechanics are listed in the Where-to-Buy-It index. Write to them to get additional information about any article in which you are interested. Say You Saw It in Popular Mechanics



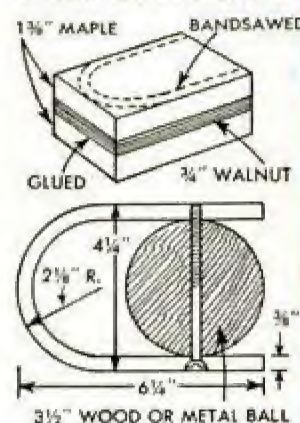
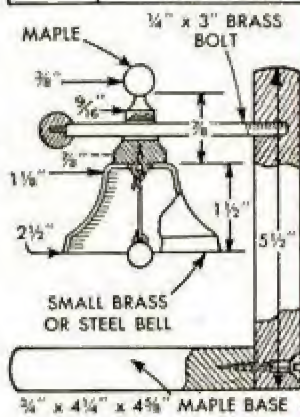
The CRAFTSMAN

Your choice in BOOK ENDS

AMONG the four designs given here, you'll find a pair of book ends to harmonize with your furniture regardless of whether the room is furnished in period or modern style.

For a den or recreation room depicting frontier days, the old west book end, Fig. 1, is just the thing. The popular cowboy motif in metal or thin plastic is fastened to a wood backing, the motif being encircled with a length of cotton string laid in a shallow groove to simulate a lariat. The base is a half circle of $\frac{3}{8}$ -in. plywood 5½ in. in diameter, recessed on the underside for a piece of lead to add weight. The lead can be shaped to fit the recess and then screwed in place.

For a more conservative setting, the mission type of book end in Fig. 2 is suitable. It is made of maple and is finished in a warm brown. The small bell can be purchased at a dime store, or it can be spun. The bell is attached to a small maple turning, which is drilled so that it can be swung on a brass rod that projects from the



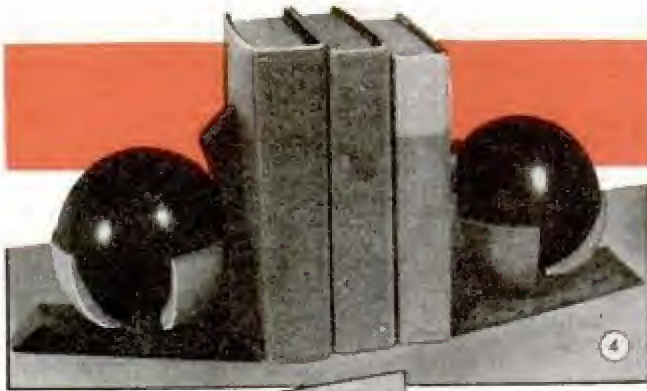
Old West



Mission



Modern

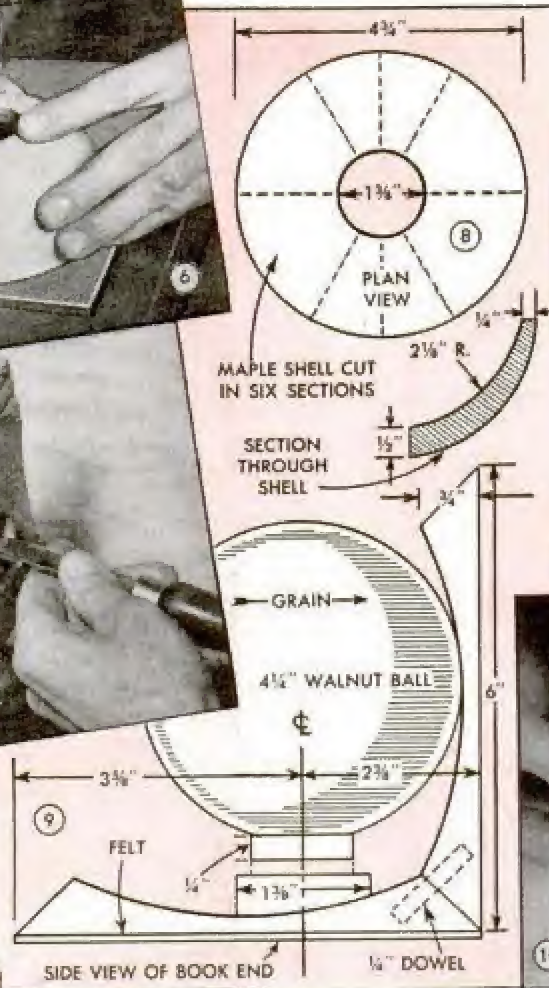


side of the book end. The modern book end in Fig. 3 features a $3\frac{1}{2}$ -in. wood or metal ball; this is mounted in a U-shaped wood frame cut from laminated maple and walnut. Finish for the wood parts should be natural to retain the color separation of the contrasting woods.

If you are looking for a book end of ultramodern design, the two-toned one in Fig. 4 will be suitable. First, the wedge-shaped base and

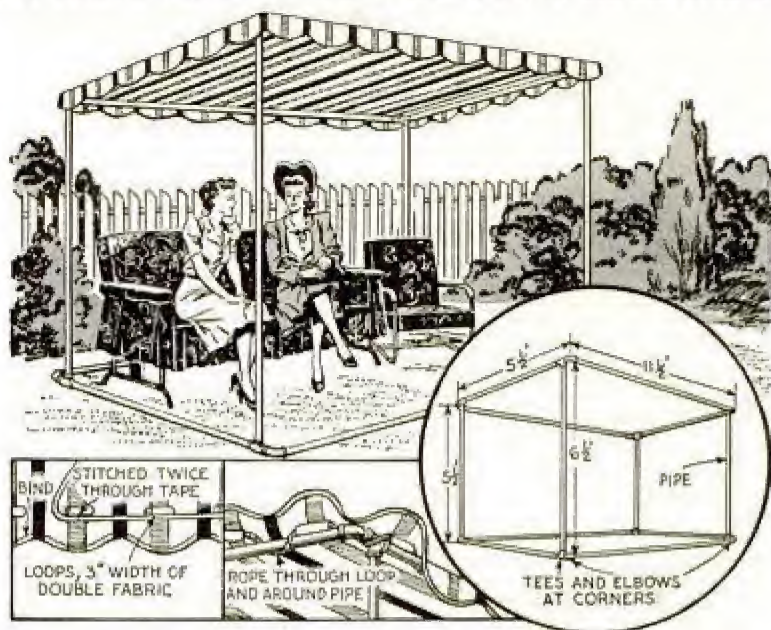
vertical piece are sawed to size. Then each one is glued to waste stock and the front surfaces turned to a concave shape, a socket being formed on the base piece to take a tenon on the ball as shown in Fig. 7, after which the two pieces are doweled together as in Fig. 9. When gluing the waste stock to the base and vertical piece, place paper between them to make separation easy. Next, the balls, which furnish substantial weight, are turned, leaving a tenon on each one to fit into the socket in the base. The decorative maple pieces in which the balls set are segments of a bowl-

shaped turning, the turning being cut into six segments, three for each ball, Figs. 6 and 8. These are glued to the balls at equidistant points, Fig. 10. To simplify the work, the balls and maple bowl are sanded and shel-lacked while in the lathe, the bases and vertical members being finished by hand. Pieces of thin felt are glued to the bases of the book ends to prevent marring any surface on which they may be placed.



This Shelter Provides Shade for Lawn Furniture

If the trees in your yard are not large enough to provide a shady spot for lawn furniture on hot summer days, here's an inexpensive shelter that will serve the purpose. It consists of a simple framework of pipe fitted with a top made of bright-colored awning material. Secondhand pipe is entirely satisfactory for the framework as this can be painted after assembling to harmonize with other lawn furnishings. When enough strips of awning material have been sewed together to cover the top, all edges are scalloped and bound with tape. Loops are then provided for attaching the top and these are made by using a double thickness of awning material stitched through heavy woven tape. To attach the top, you thread a rope through the loops and around the pipe frame.



Filter Bowl on Kerosene Stove Prevents Clogged Fuel Line



Clogging of the fuel line on a kerosene stove was avoided by one householder who fitted a gasoline filter or sediment bowl in the line between the supply tank and the burners. The bowl was taken from an old car fuel line and was installed by cutting out a

section of the stove fuel line and threading the ends to screw into the bowl. Removing and cleaning out the bowl at regular periods is all that is necessary.

There is no need for your kitchen linoleum to become scratched from the furniture if you will glue pieces of felt to the bottom of the legs of tables, chairs, etc.

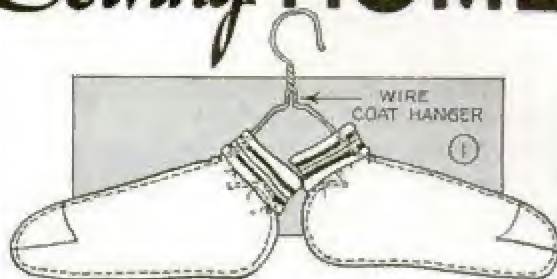
Twin Spectacle Case in One Unit

Anyone who has to carry two pairs of spectacles will find this twin case a time and pocket-space saver. It is made from two aluminum cases cemented together back to back with plastic wood. First sand the backs of the cases with very fine sandpaper, and then coat them with cellulose cement. Let this dry and apply plastic wood. Stick the cases together immediately, filling in around the edges with the plastic. Smooth the wet plastic with the fingertip dipped in alcohol. When dry apply a coat of cement and sprinkle aluminum powder on the tacky surface.





Solving HOME

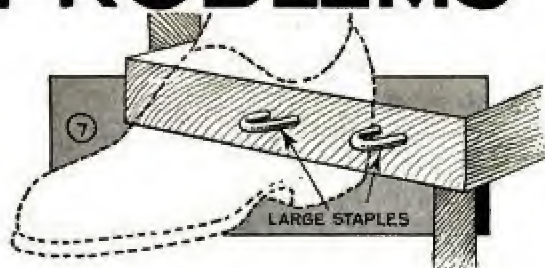


1, Laundered stockings of the ankle type will keep their shape if dried on a wire coat hanger which has been cut in the center and bent to the shape shown. 2, Made of colorful oilcloth and sewed to a strip of the same material, pockets provide handy receptacles for your toilet articles when hung on the mirror posts of a dresser or vanity. 3, The tedious job of removing pinfeathers from a fowl can be simplified by using a strawberry huller with which you can grip the feathers close to the skin of the bird. 4, You can avoid water marks on furniture caused by moisture on a flower vase if a piece of waxed paper is slipped under the vase. If the paper is cut to the same pattern as that of the daily used under the vase, the paper will be unnoticeable

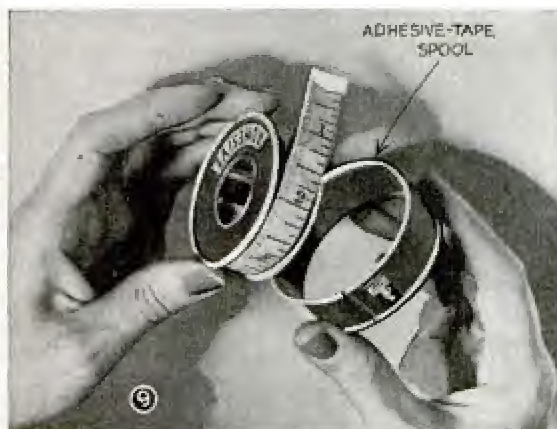
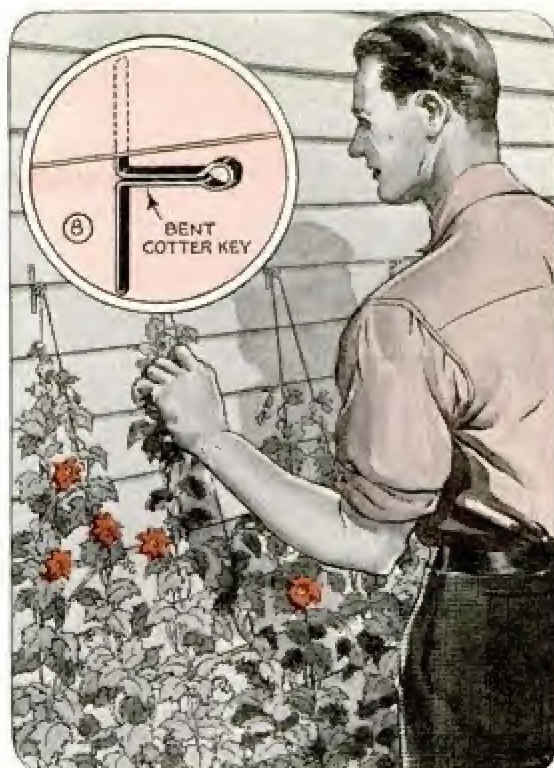


5, Clean bottle caps with the cork inserts removed will serve as candy molds. If they are greased, the candy will come out easily after it has hardened. 6, A pin pushed into the side of the cork in a salt or pepper shaker will prevent it being pressed in too far

PROBLEMS



7, Driven into the edge of a porch step, two large staples provide a good bootjack for removing heavy rubbers easily. 8, Cotter keys bent as shown in the circle and slipped under the siding boards provide good fasteners for strings on which flower vines climb. 9, You'll find an empty adhesive-tape container just the thing on which to wind your tape measure and keep it clean. 10, Small holes in a window or door screen can be repaired neatly with cellulose cement, which is not noticeable when dry. First, bring the broken ends of the wires together with small tweezers and tie them, or use a patch if the hole is a large one. Coat both sides of the patch with the cement and then press it in place



11, "Moleskin" adhesive, which can be obtained at most drug stores, is ideal to prevent bric-a-brac from scratching finished surfaces of furniture. 12, The grooved section of a flat curtain rod is just the thing to screw on inner sides of a drawer to hold partitions



Duster Brush Wipes Excess Water From Beverage Bottles



If you own a refreshment stand and cool beverages by keeping the bottles in ice water, here's a quick way to wipe excess water from the bottles before serving them to customers. Just attach a cotton duster brush in a convenient position under the counter with a couple of large staples. Only a second is required to push a bottle through the brush, which can be removed easily for washing whenever desired.

New Handle 'Burned' in Hammer

To fit a new handle in a hammer easily, first shape it so that it is slightly oversize and bevel the end a little. Then apply a mixture of grease and fuel oil to the end

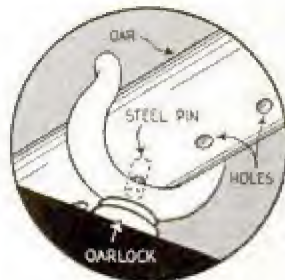


and ignite it, letting the oil flame until the wood is almost at the burning point. Now drive the handle quickly into the head and wedge it as usual.

—Benj. Nielsen, Aurora, Nebr.

Twisting of Oars When Rowing Avoided by Pins in Oarlocks

You can hold the blades of loose oars at the correct rowing angle without strain on the hands and wrists, by using short steel pins in the bottoms of the oarlocks. The pins are driven tightly into shallow holes drilled in the oarlocks and project into corresponding holes bored in the oars.



Tumblers Serve as Place Cards



A novel and unusual method of seating guests at a table is to write their first names or initials on the water glasses at the plates. This is done with heavy cord, either white

or colored. As the cord is formed into letters, it is held in place with small pieces of cellulose tape, using small dabs of cellulose cement to affix them more permanently. The letters or writing can be stripped off easily after it has served the purpose.

—Kenneth Murray, Colon, Mich.

Handle of Darning Egg to Mend Fingers of Ladies' Gloves

With a little trimming the handle of a darning egg is just the thing to insert into the finger of a glove while mending it. The handle can be trimmed to the proper shape easily with a knife and sandpapered to the desired diameter.

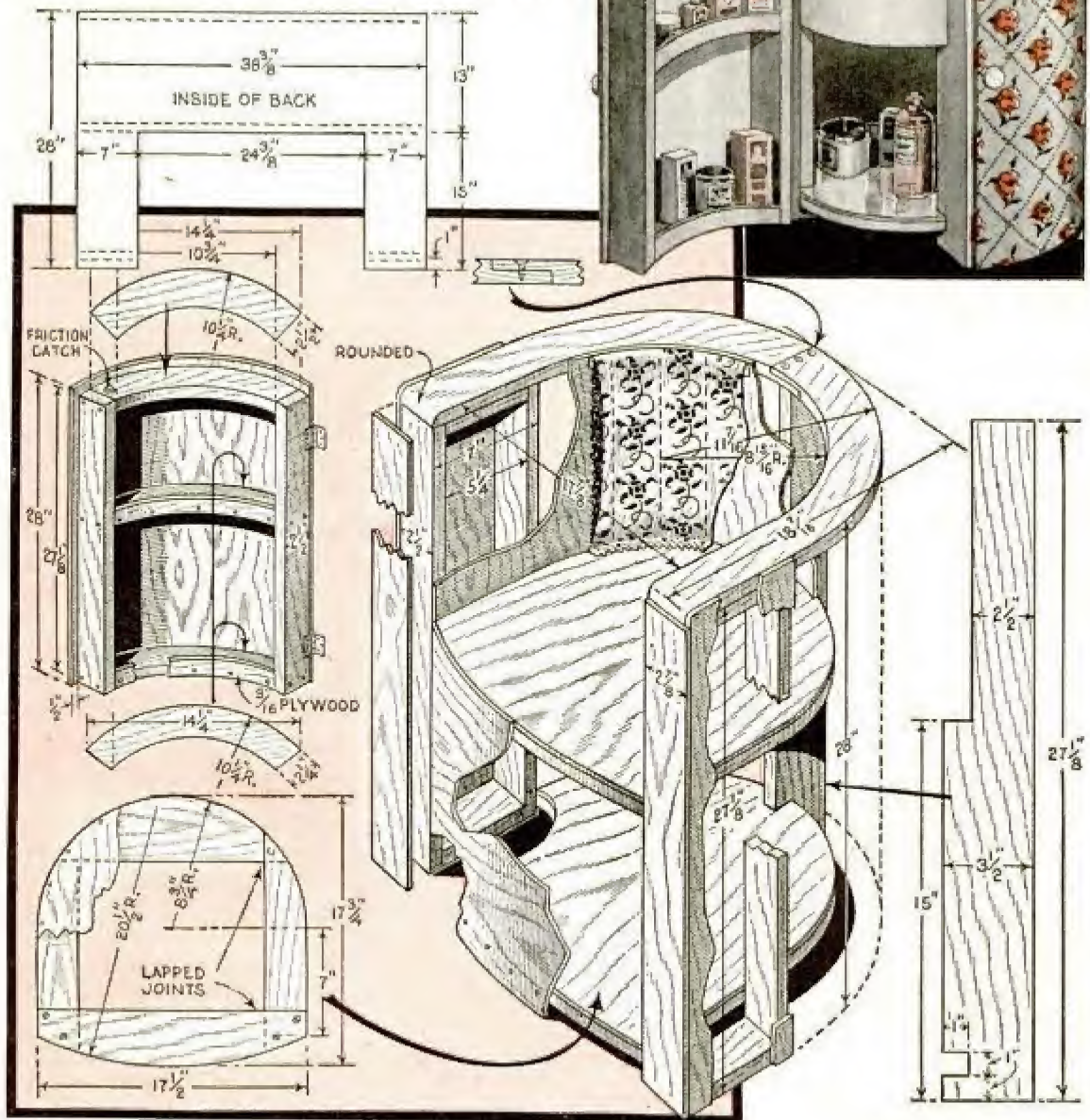


BOUDOIR CHAIR

has storage space

UNUSUAL in design, this chair has doors at the back with shelves on which can be stored small articles, such as lotions and make-up. Also, there's space under the seat for larger articles. After band-sawing the bottom, seat and frame members to shape, the chair is assembled as indicated, and then covered with $\frac{3}{16}$ -in. plywood, including the seat compartment. The entire chair is upholstered, the seat compartment being padded on the sides. A cushion is used on the seat, and is shaped to fit.

—W. K. Vining, Daytona Beach, Fla.



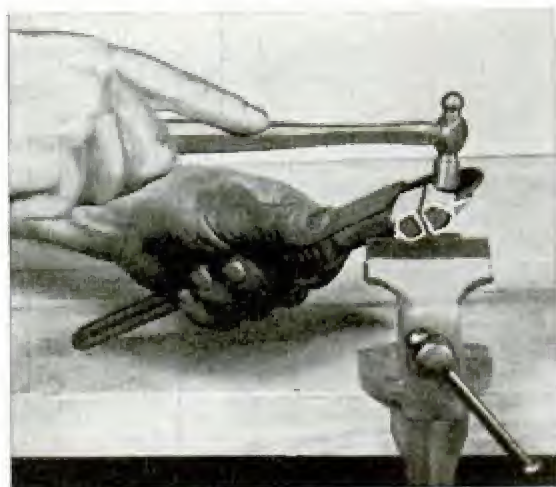
Adjustable Footrest in Rowboat Made of Bamboo Pole



Finding the permanent footrest of a rowboat not adapted to his height, one sportsman cut a length of bamboo from a fishing pole and bent it to fit across the bottom of the boat. The pointed ends of the bamboo engaged the sides of the boat sufficiently to prevent slipping.

Soft Face for Jaws of Wrench Or Vise From Bearings

Protection for the finest finish, yet ample strength to withstand the hardest service is provided by soft wrench or vise jaws made from steel-backed, babbitt-faced motor bearings. The bearings are cut to a suitable size to form the jaws. Then by hammering them to form, the stiffness of the steel back will prevent their coming off

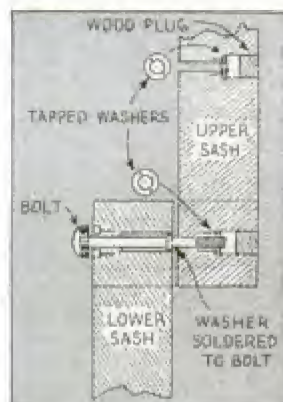


while in use. The babbitt gives the same protection that is obtained by using copper or lead with the advantage that it does not break down as quickly as these materials when in hard service.

Method of Locking Window Sash At Any Desired Height

With this method you can lock window sashes in the closed position, or at any predetermined opened position. To install the lock, close the

sashes tightly and drill a small hole through the check rails for a small bolt. Next counterbore the check rail of the upper sash and fit in a tapped washer, fastening it in place with a couple of brads. Then plug the hole and counterbore the



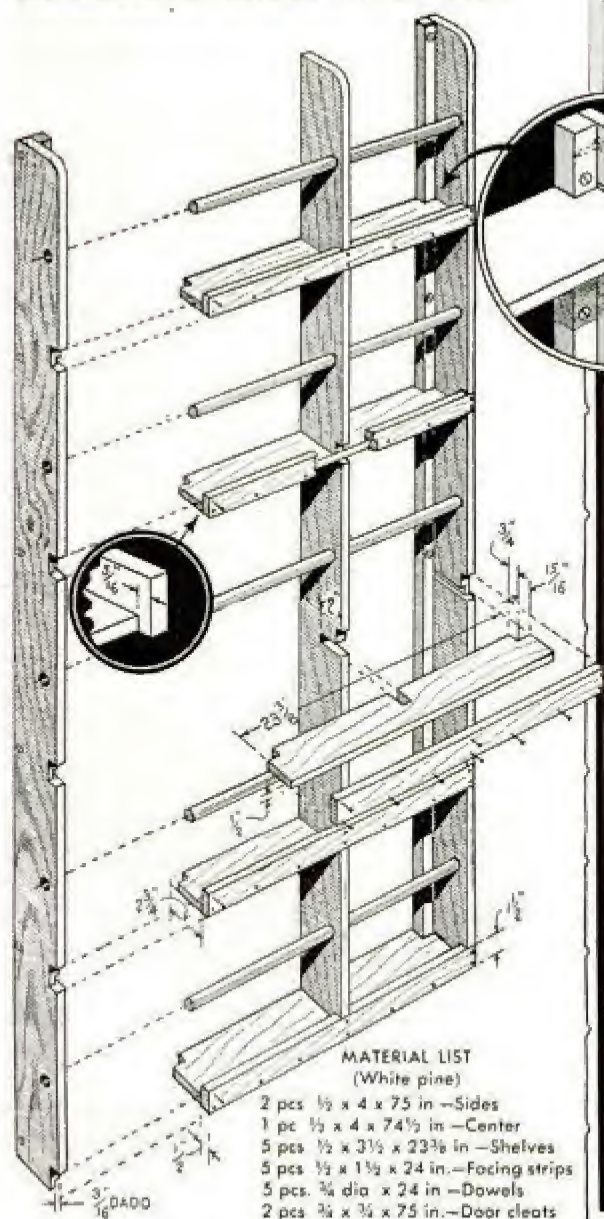
hole in the lower-sash check rail to take a smaller washer, which is soldered to the bolt to keep it from being pulled completely out of the hole. At one or more locations on the upper sash, provide holes and tapped washers to take the bolt as before. These lock the sash in the raised position.

Blackout Paint on Windows

Black, dark brown and dark olive drab paints of a spar-varnish type applied on the outside surface of ordinary window glass are recommended for blackouts, where it is necessary to paint windows such as skylights. The paint should be flat—not glossy—in order to avoid reflections. Application of blackout paint to the inside of glass causes a mirrorlike effect so that moonlight and flares are reflected more than by uncoated glass. An inside painting job on windows therefore, is not fully effective as a blackout. Light can be shut off and reflected glare eliminated by painting the outside of windows. To counteract the depressing effect of darkened windows, a white undercoat can be applied before the blackout paint. On plate glass, it is advisable to use lighter colored paint because dark colored paints absorb so much heat from the sun that the glass is likely to crack.

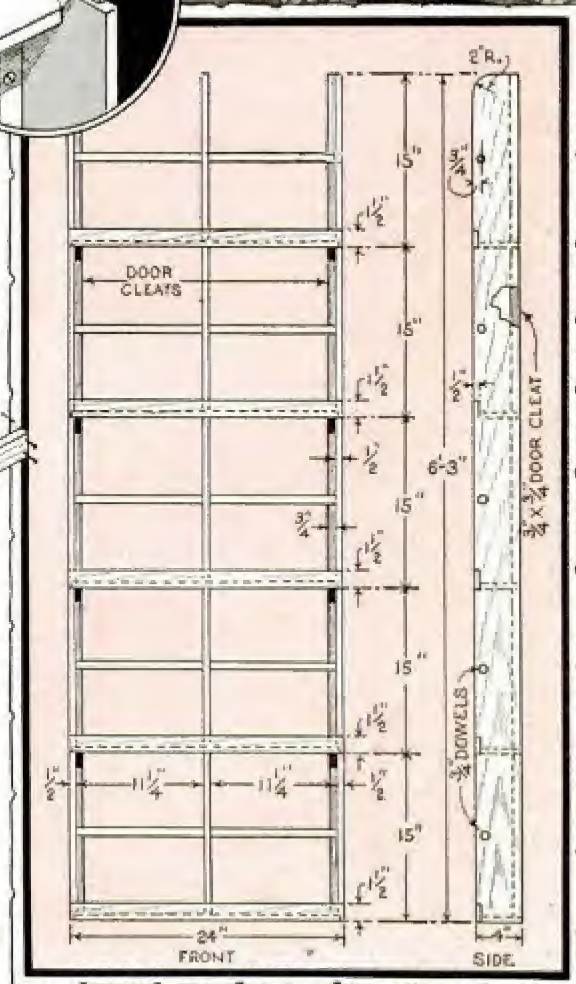
Closet-Door MAGAZINE RACK

THOSE who live in single rooms or small apartments will find this rack a space saver for keeping favorite magazines filed neatly and hidden from view. Although the rack is light in weight, it may be necessary to add another hinge and reinforce the door at the corners, especially if the rack is loaded heavily. Screws driven through long cleats on the inner surfaces of the side members are used for attaching the rack to the inside of the door.



MATERIAL LIST (White pine)

- 2 pcs $\frac{1}{2}$ x 4 x 75 in.—Sides
- 1 pc $\frac{1}{2}$ x 4 x 74½ in.—Center
- 5 pcs $\frac{1}{2}$ x 3½ x 23½ in.—Shelves
- 5 pcs $\frac{1}{2}$ x 1½ x 24 in.—Facing strips
- 5 pcs $\frac{3}{4}$ dia x 24 in.—Dowels
- 2 pcs $\frac{3}{4}$ x ¾ x 75 in.—Door cleats



Sheet-Metal Work Held Safely On Drill-Press Table



Small pieces of thin sheet metal can be held safely on a drill-press table with this simple clamp, which consists of a handle cut from $\frac{3}{4}$ -in. stock and a bolt with washer and wing nut to fit. The underside of the handle is covered partially with a strip of fabric belting tacked or cemented in place while a hook is bent on the head end of the bolt so that it will slip over the table edge. In use, the work is placed under the wood strip and pressure is exerted on the handle to prevent the work from turning when operating the drill.

Lapel Button Altered to Avoid Losing It Accidentally



clear the notch, and re-point it. When you put the button on a garment, press the point into the notch and turn the upper

part. This will move the notch to one side so that the point of the pin rests firmly under the rim, thus locking the button securely in place.

Toothpick Used as Screw Driver For Tiny Mechanisms

When assembling a watch, clock, camera shutter or other small mechanism, starting of tiny screws can be simplified by using a toothpick. Wet the wedge-shaped end and break it off so that it fits tightly in the



screw slot. This makes it possible to hold the screw in position for easy starting.

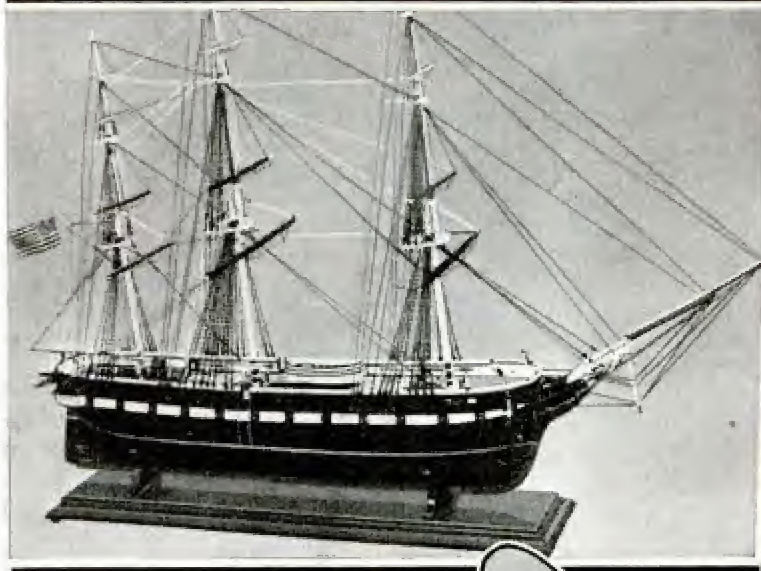
Powder Sprinkled Over Stamps Prevents Sticking Together

I often enclose several postage stamps when corresponding with a soldier friend as it is sometimes difficult for him to secure stamps, especially while on maneuvers. On one occasion, I learned that the stamps had stuck together and were impossible to separate. However, I found that by spreading a little talcum powder on the gummed side of the stamps, similar trouble was avoided. This idea has also proved effective in preventing stamps from sticking while carrying them in a billfold.

—William Swallow, Brooklyn, N. Y.



Model of U.S. Frigate "CONSTELLATION"



By H. W. Potter

PART II

Bow head, bulwarks and gun ports

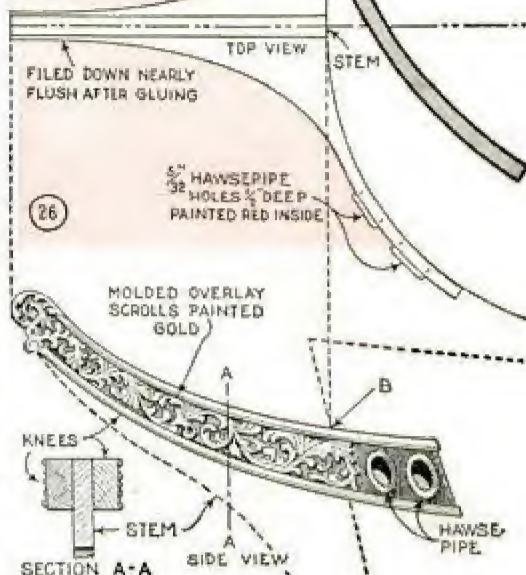
NOW that you have the hull carved and the stem, rudder and keel fitted, start building up the head at the bow. If you haven't already made a cradle to hold the hull upright, make a temporary one of pine and later replace it with a nicely finished one of walnut as detailed in Fig. 28. The stem knees are rather tricky to fit, especially where they butt

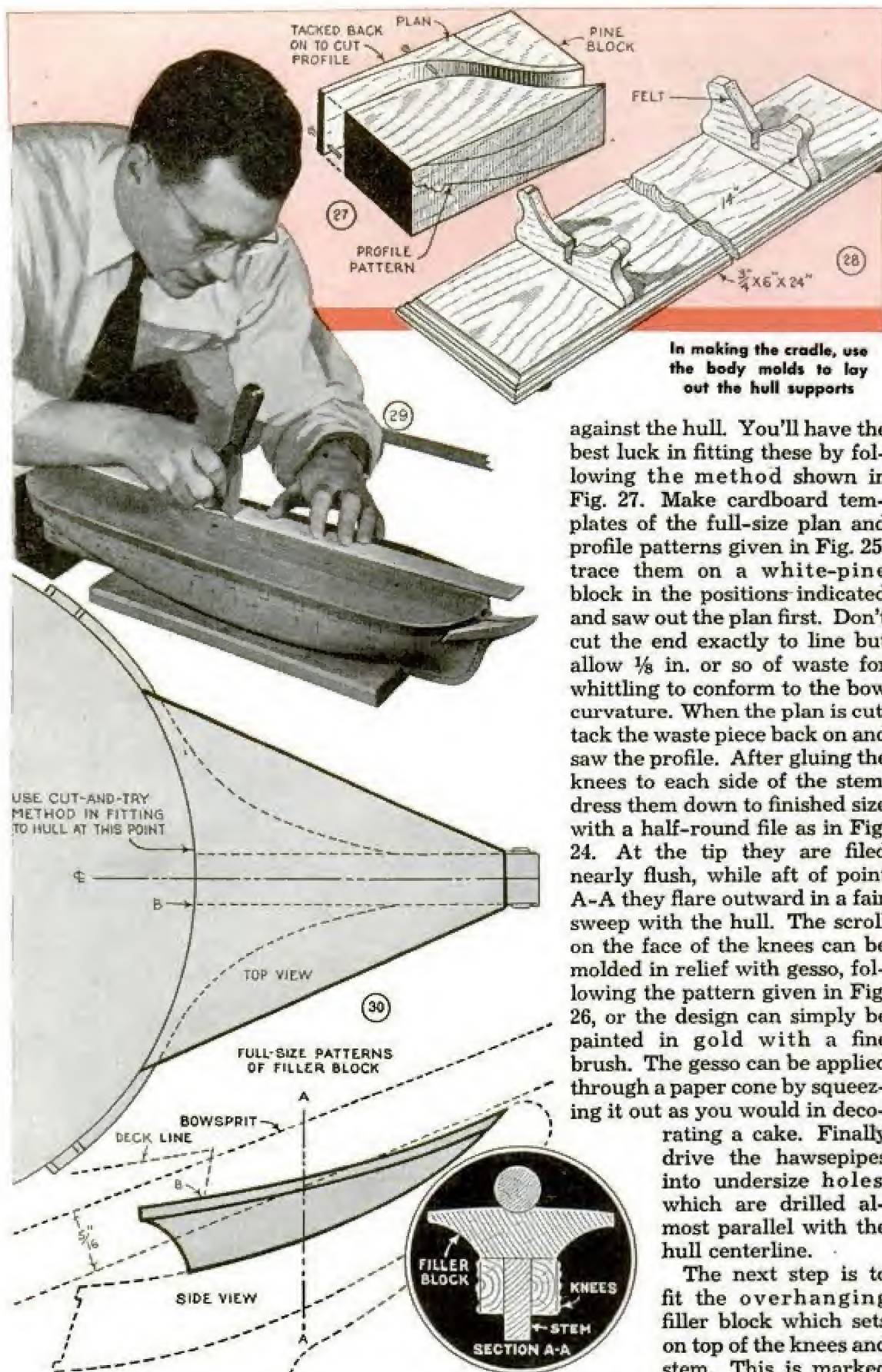


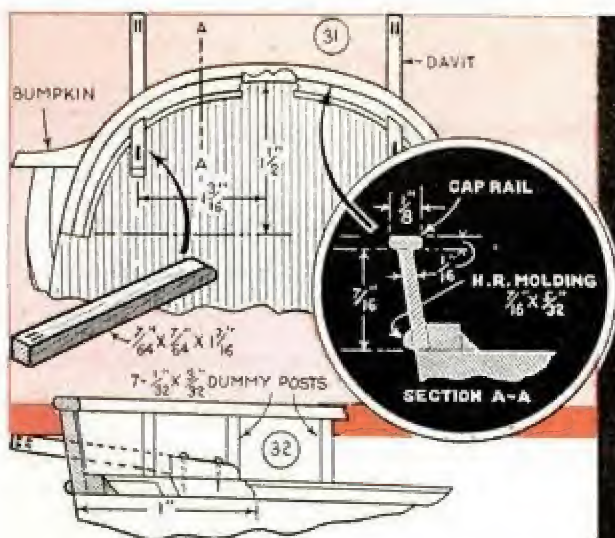
SHAPE OF LIFT H AT POINT B



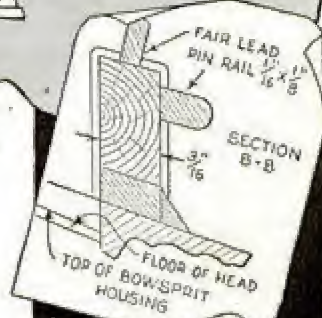
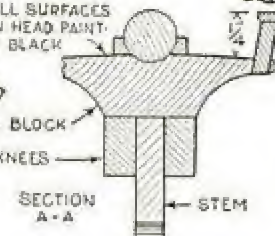
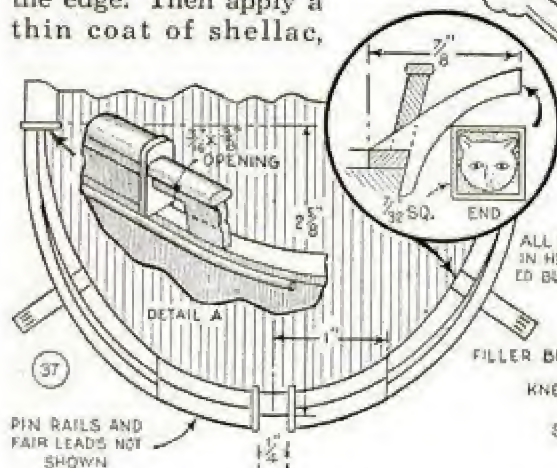
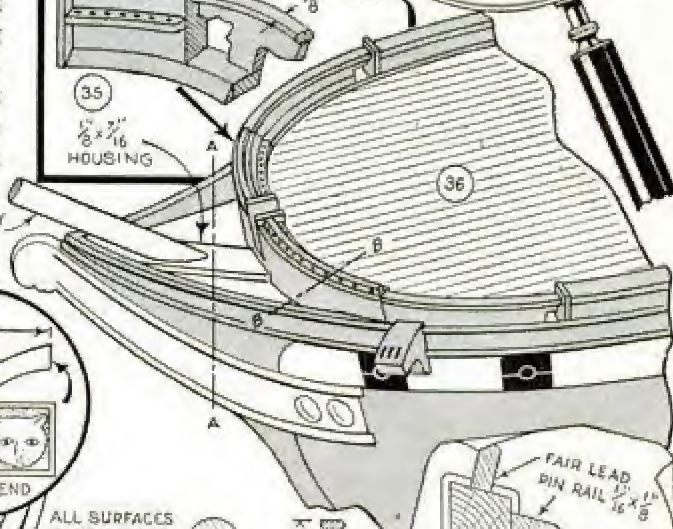
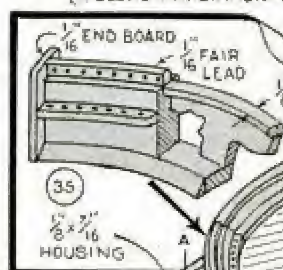
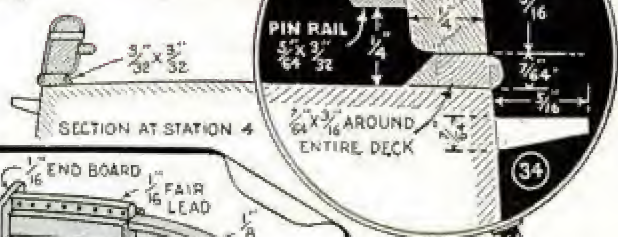
Compared with the scroll design at the right, this bow view of "Constellation" shows how faithfully the knee ornamentation has been reproduced in the model

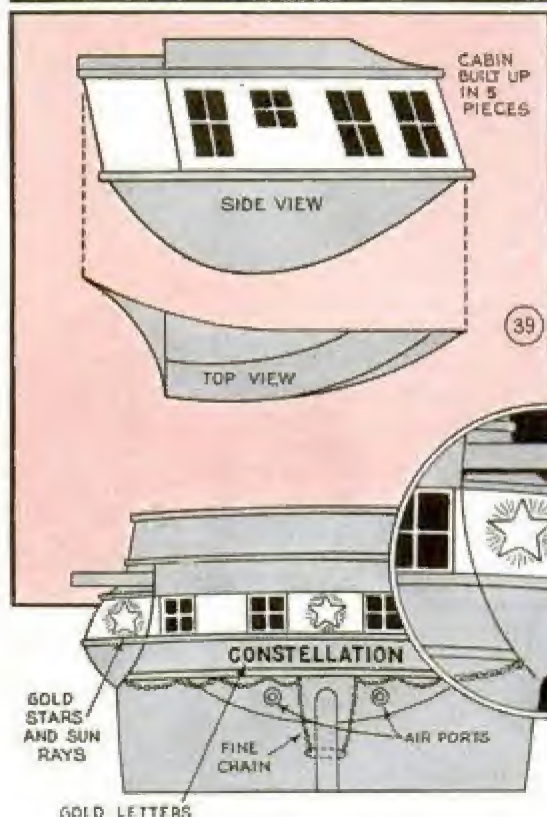
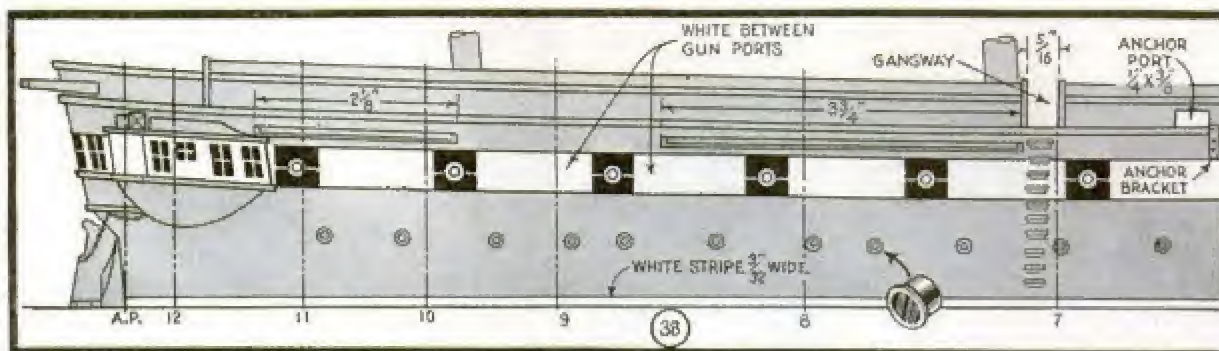






from the full-size plan and profile patterns given in Fig. 30 and cut and fitted to the hull the same way you did for the knees. You will notice in the circular detail below Fig. 30 that the block is flared on the underside. This cove follows the knee line at the bottom, while at the top it runs parallel with the edge as marked. Before going any further, it is well to score the deck to represent planking. This is done by stepping off $\frac{3}{32}$ -in. spaces each way from the centerline with dividers, and then drawing a putty knife along a flexible straightedge which you hold firmly in line with the marks as in Fig. 29. Bear lightly at first to keep the blade from running out of line with the grain and producing crooked "planks." About three passes of the knife will make the right score. Sand the wood lightly, dust and gauge a line completely around the deck $\frac{1}{4}$ in. in from the edge. Then apply a thin coat of shellac,





The odd shape of the quarter galleries makes them difficult to duplicate unless assembled in five layers. Thin pieces applied to overhang the top and bottom of the center section form the molded edges shown



leaving the outer edge bare for gluing the bulwarks.

Next, mark the centerline of the air ports, and locate the gun ports. Both run parallel with the deck, the gun ports being located within a $\frac{3}{8}$ -in. band drawn $\frac{5}{16}$ in. down from the top and the air ports $1\frac{1}{8}$ in. Individual spacing of each port is made in relation to the station lines. (See Fig. 38.) In recessing the gun ports, Figs. 41 and 42, take pains to make each mortise clean cut and slightly undersize so that the shutters, after being coated with cement, can be tapped snugly in place flush with the hull.

Begin the deck bulwark at the stern as detailed in Figs. 31 and 32. You can form the main part of this by steaming a thin strip and bending and clamping it around a wood block that is shaped to coincide with the stern, or it can be cut U-shape from a solid piece. In the latter case, the outer radius is cut oversize and glued to overhang the stern, after which it is filed flush. Regardless of which method you use, glue in place the inner molding at the base first so that a rabbet will be had in which to glue and clamp the bulwark as shown in Fig. 33. The davits pass through square holes in the bulwark which are made by first drilling a hole and then filing it square. The magnified detail in Fig. 34 shows how the starboard and port bulwarks are built up. These follow the edge of the deck from the aft end boards at the stern bulwark to a point $2\frac{5}{8}$ in. in from the end of the bow and assume the same tumble home or inward rake of the hull. (See Fig. 37.) Below each side gangway which is cut through at station No. 7, a row of steps is added to the side of the hull. The bow bulwark is practically the same as at the stern except that it is thicker 1 in. each side of the centerline. Fig. 35 and the sectional detail below Fig.

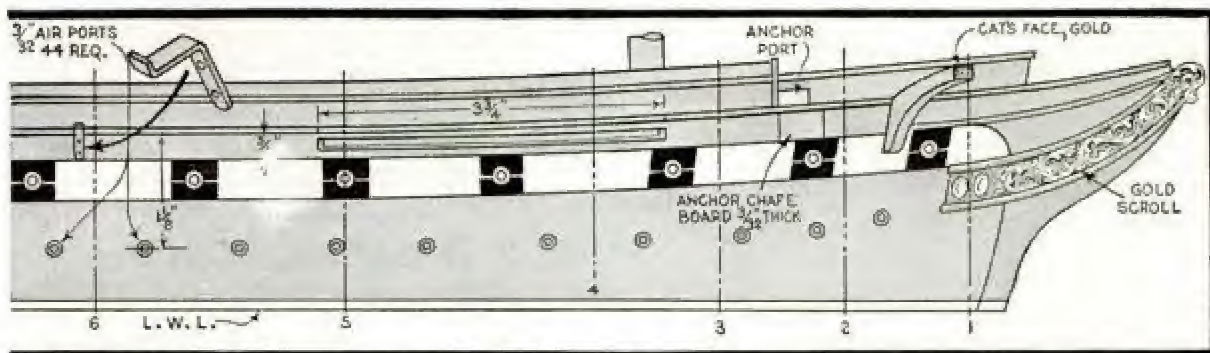
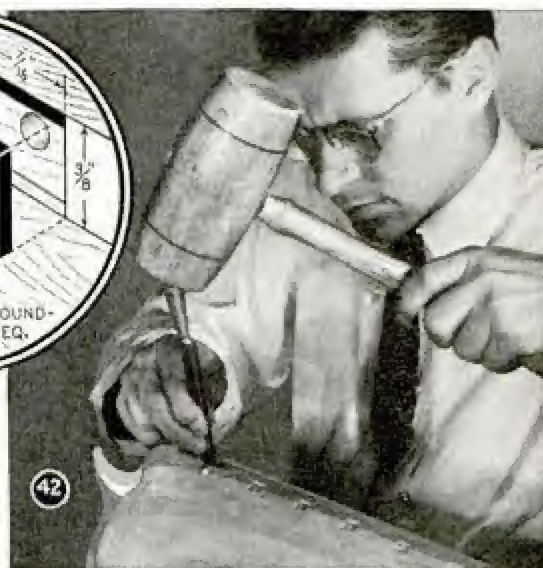
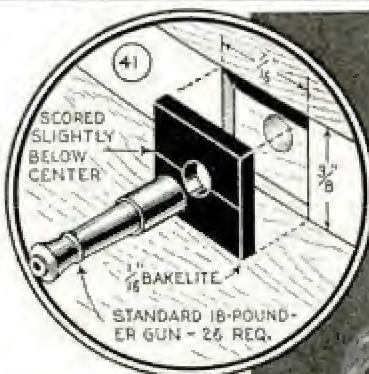


Fig. 36 show this in detail. Complete the bow head by fitting bulwarks to the edge of the filler block, butting the ends against the hull in a sweeping line with the deck. Study Figs. 36 and 38.

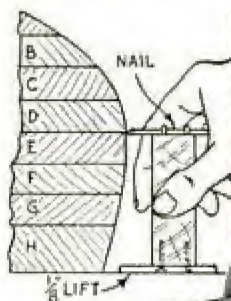
You'll do best to build up the quarter galleries from five separate layers rather than try to cut them from a solid block. Figs. 39 and 40 give full-size patterns of the top, side and end. The windows at the stern are recessed $\frac{1}{8}$ in. and fitted with green celluloid to represent glass. Finish up by adding the channels, catheads, bumpkins, anchor brackets and the ornamentation at the stern. The name "Constellation" is made up of $\frac{1}{8}$ -in. white-metal pattern letters of the kind sold at hardware stores handling mill supplies.

As a last step before painting the hull, the waterline is scribed. With the hull in its cradle or turned upside down as shown in Fig. 43, level it both lengthwise and laterally. Cut the block supporting the scriber to bring the point in line with the joint between lifts D and E. After scoring the hull from stem to stern, remove the lift on the bottom of the block and scribe a second line parallel to the first. Hold the block at an angle to keep the scriber from digging into the end grain. Score the lines heavily enough to make them visible under paint so that they can be used as a guide in applying the white waterline stripe.

(To be continued)



The gun ports are cut slightly undersize so that the Bakelite shutters can be tapped snugly in place, after which the holes in the shutters are used as a guide in drilling on through into the hull. The brass guns, which you purchase, project approximately $\frac{1}{2}$ in.



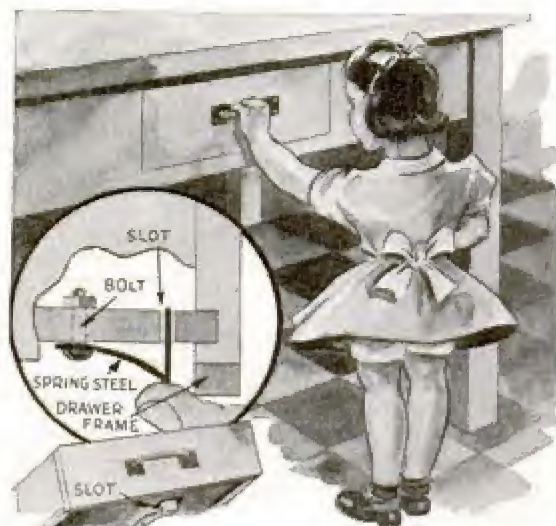
Flashlight Shield to Take Notes From Educational Movies



With this simple shield on a flashlight, a student can illuminate his paper to take notes while viewing an educational movie without disturbing others around him. The shield consists of a disk of opaque paper clamped under the lens rim of the flashlight, one side being turned up to permit light to shine on the note paper.

Hidden Catch on Table Drawer Prevents Child Opening It

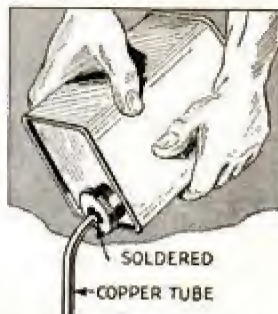
It will take some time for small children to learn how to open the drawers in your kitchen worktable if they are fitted with



these hidden spring catches. To make them, just bend strips of spring steel to the shape indicated and bolt one on the underside of each drawer bottom. A slot for each catch permits it to be sprung up for opening the drawer by reaching under the table.

Tube Soldered on Oil-Can Top Eliminates Spilling

To overcome the difficulty of pouring oil from a container fitted with an ordinary screw cap, I punched a hole in the cap and soldered a copper tube on it. This spout makes it



easy to pour oil into small openings without spilling and, as many containers of this type have interchangeable caps, I have also found the cap handy when screwed on cans containing other liquids.

—W. F. Schaphorst, Newark, N. J.

Air-Rifle Shot Weights Ink Bottle To Avoid Upsetting It



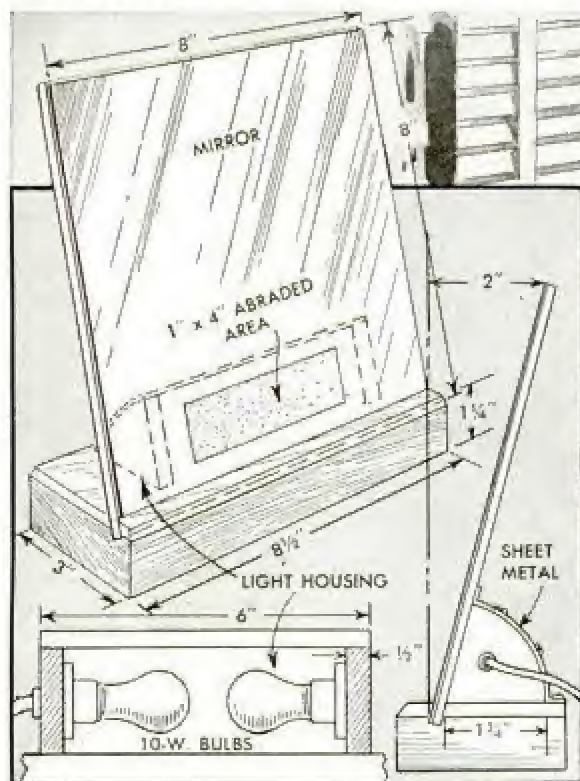
After ruining several blueprint tracings by spilling ink on them, one draftsman poured some air-rifle shot in his ink bottle to prevent it from being upset easily. This provides added

weight on the bottom of the bottle, making it have a tendency to slide on the table instead of upsetting when accidentally hit with a T-square or other drawing instrument.

EVERYBODY IS AN INVENTOR

Everybody has devised some shortcut or gadget to save time, labor, or money. If your idea would be applied by many other readers, why not pass it along to them and get a check for doing so? Just make a simple sketch or take a photo and explain the idea in 50 to 100 words. We pay promptly for accepted articles. Address Homecraft Editor, Popular Mechanics Magazine, 200 East Ontario Street, Chicago, Illinois.

Illuminated Mirror for Your Make-Up Table



Two lamps in the base of this neat vanity mirror provide light through an abraded portion of it to illuminate your face. The base proper is a solid wood piece grooved near the front edge to take the lower end of the mirror so that it will stand at an angle as indicated. The lamp housing is located on the base just behind the groove so that the edges of the open end are flush with the back of the mirror. The ends of the lamp housing are two segments cut from a wood disk, while the top consists of sheet metal formed over them and screwed in place. A porcelain socket is mounted on each end of the housing. After the base

and lamp housing have been completed, a portion of the mirror in front of the housing is abraded to diffuse the light. This is done by removing the silver and rubbing the glass with emery cloth until it resembles a ground glass. A mask to form neat edges and prevent the abrasive from damaging the silvered portion of the mirror, should be cut from sheet metal and held firmly over the portion to be abraded while using the abrasive. Before final assembly, a thin coat of rubber cement should be applied to the sides and bottom of the groove in which the mirror is set.

—Dale Van Horn, Lincoln, Neb.

Thin Paper Is Cut Easily When Backed With Cardboard

Trouble experienced in cutting tissue or other very thin paper with an ordinary paper cutter can be overcome by slipping a scrap piece of cardboard under the paper as shown. The cardboard backing prevents the tissue from bending over the cutter edge as the knife is brought down.

☛ Ends of window shades will be less likely to tear if they are attached to rollers with rubber cement in addition to tacks.



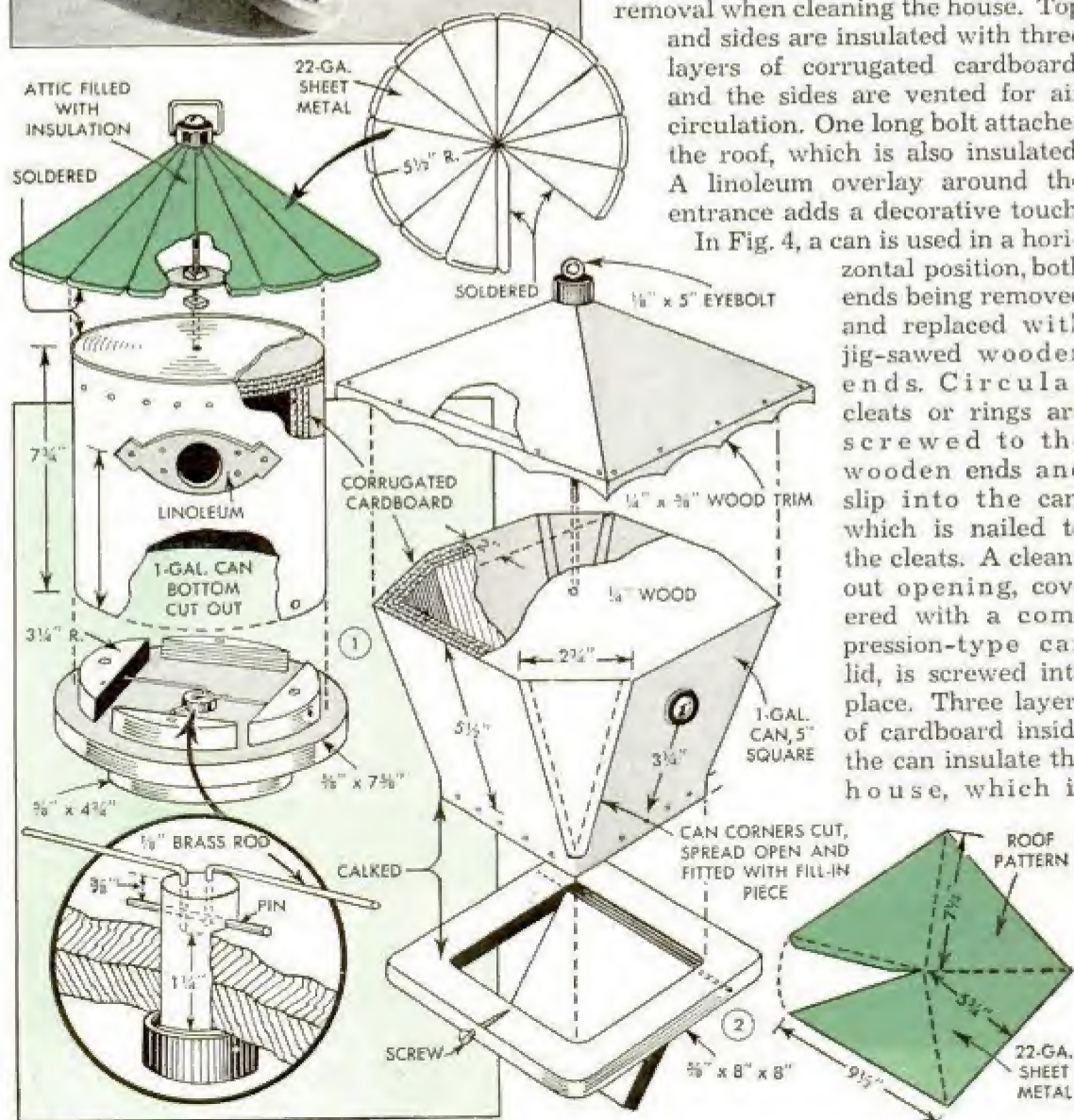
Insulated WREN

By A. L. Mills



USING empty tin cans, scrap wood and corrugated cardboard, you can make attractive wren houses that will be cool and comfortable inside. Those pictured in Figs. 1 and 4 are examples of what can be done with round 1-gal. cans. In the first one, the can is used in a vertical position, and a wooden base is substituted for the can bottom, which is removed. In the circular detail, note the novel locking feature used to hold the base for easy removal when cleaning the house. Top and sides are insulated with three layers of corrugated cardboard, and the sides are vented for air circulation. One long bolt attaches the roof, which is also insulated. A linoleum overlay around the entrance adds a decorative touch.

In Fig. 4, a can is used in a horizontal position, both ends being removed and replaced with jig-sawed wooden ends. Circular cleats or rings are screwed to the wooden ends and slip into the can, which is nailed to the cleats. A clean-out opening, covered with a compression-type can lid, is screwed into place. Three layers of cardboard inside the can insulate the house, which is



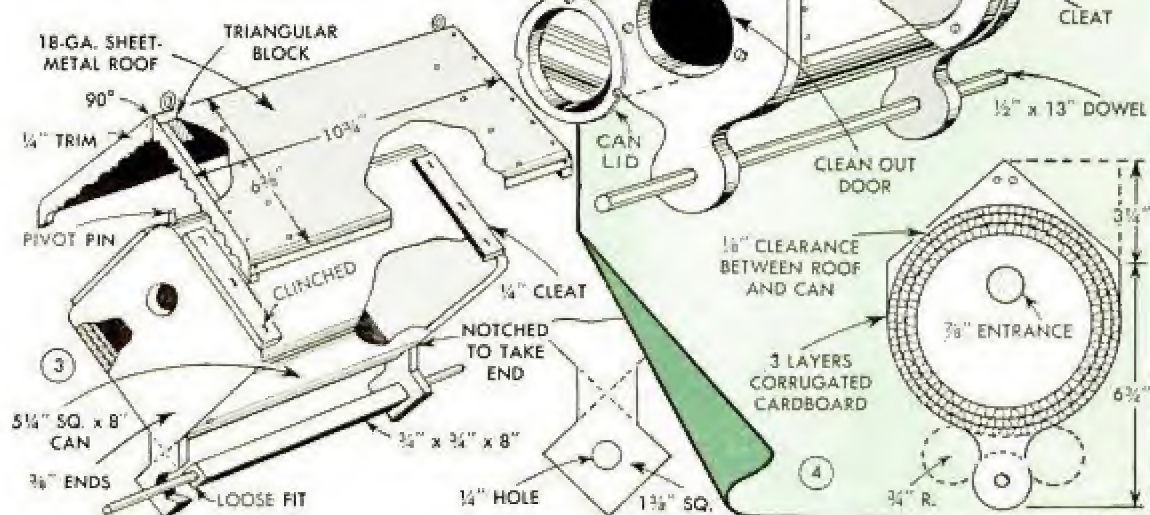
HOUSES of Metal

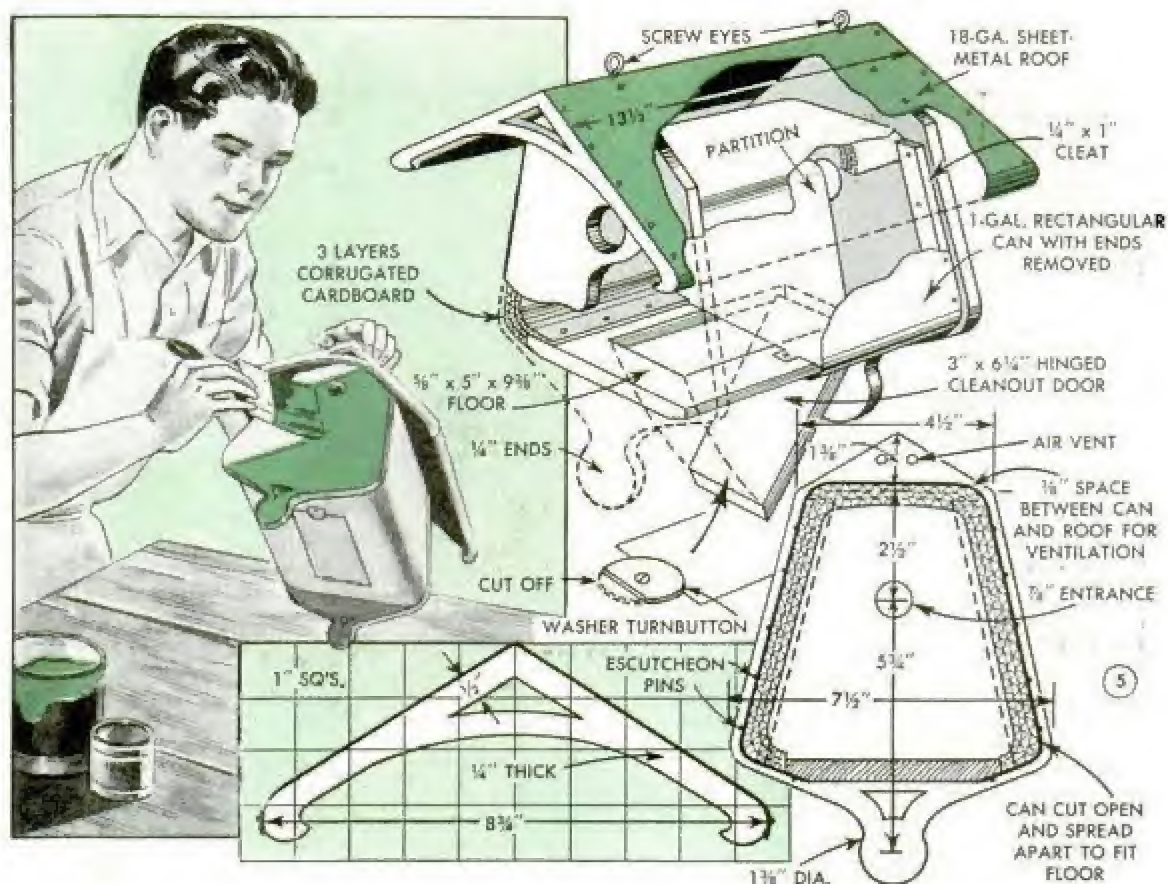
How old tin cans and scrap wood can be utilized in building durable wren houses that stay cool inside. Each design has a handy arrangement for cleaning out old nests



roofed with $\frac{1}{4}$ -in. wood. A decorative touch is added by nailing strips of perforated metal screen to the roof edges. When assembling the ends to the can, be sure that they are located to allow at least $\frac{1}{8}$ in. clearance between the can and the roof. This is to permit air to pass under the eaves and out of vent holes in the gable ends to cool the attic.

The houses in Figs. 2 and 3 are assembled from square cans. In Fig. 2, both ends of the can are removed and





a wooden top and base are used. Notice that the center portion of the base is pivoted for easy cleaning. A long screw through one edge of the base locks the pivoted portion in the closed position. The unusual shape of the can is obtained by slitting the corners and soldering triangular fill-in pieces in them after spreading the top of the can. Scrolled wood decorates the edges of the metal roof, which is attached by a long eyebolt. Further decoration is added by a plastic or linoleum ring around the entrance hole.

The end containing the entrance opening of the house in Fig. 3 swings outward for cleaning. It is held by a pivot pin at the

top and by two screws at the bottom. Cleats are nailed to the can near the ends for attaching the roof, the latter being reinforced at the ridge by triangular corner blocks to take screw eyes. These are for suspending the house.

The neat shape of the house in Fig. 5 is obtained by using a rectangular can opened at one side, which is spread and nailed to the wooden floor of the house. A clean-out door is provided in the floor and is closed by a turnbutton fashioned from a washer. The roof is metal with a jig-sawed trim at the ends. Cardboard insulation is used inside the can, and holes are provided in the wooden ends to ventilate the attic.

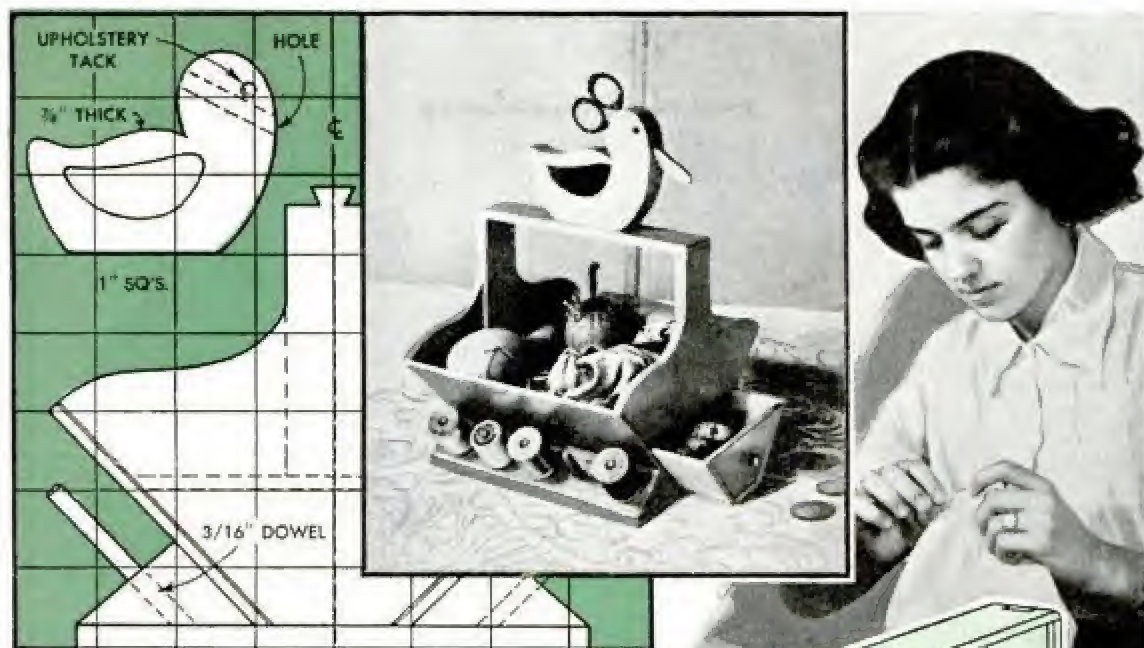
Steel Wool in Hand Grinder Cleans and Polishes Small Surfaces



For polishing and cleaning small surfaces, steel wool used with a hand grinder will do the work rapidly. The wool is held in a grinding wheel accessory and is taped in place. A pad of cotton covered with a circular piece of flannel and held on the wheel in the same manner makes a good buffing tool for jewelry and similar work.

Because a large sponge drips less than a cloth, it is excellent for washing woodwork.

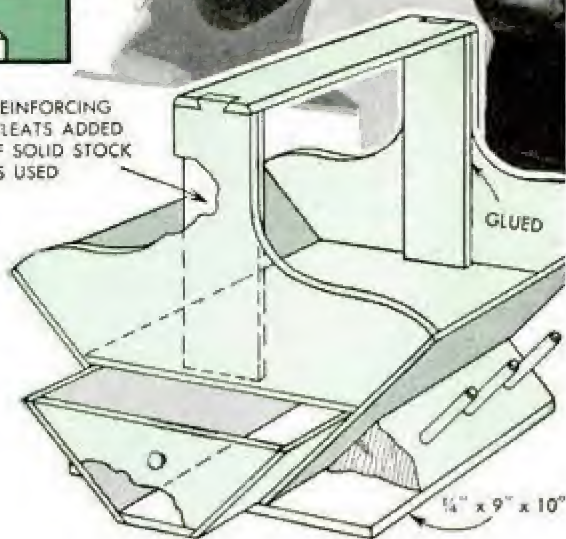
Sewing Box Has Accessory Drawer in One End



This sewing box has a compartment for unfinished sewing, pegs to hold spools of thread, a drawer for accessories and a jaunty duck cutout atop the handle to hold a pair of scissors. Made of either solid or plywood, the box is trough shaped and rests on a flat base, triangular filler blocks being used at the sides for rigidity. The blocks carry the spool pegs, and the box ends extend upward for attachment of the handle, which is dovetailed in place. The drawer, which is also shaped like a trough, slides in an opening formed by the bottom of the sewing compartment.

—Bertram Brownold, Woodmere, N. Y.

REINFORCING
CLEATS ADDED
IF SOLID STOCK
IS USED



Dog's Leash Kept in Neat Case Riveted or Sewed on Collar



Fasten a neat case on your dog's collar and you can roll up the leash and leave it attached permanently. In this way, the leash is always at hand when needed and there is no danger of losing it. The case shown in the photograph is an old coin purse fitted with a slide fastener. It is attached to the collar with two rivets although it could also be sewed on with heavy thread if desired.

¶To prevent leather upholstery from sticking to your clothing wash it with gasoline and allow to dry. Then mix lacquer and lacquer thinner in equal parts and apply over the leather.

Lacquer Preserves Soap Carvings And Gives "China" Finish



To prevent my soap carvings from drying out and crumbling, I put two coats of high-luster lacquer on them. The lacquer not only preserves the carvings but gives them a high luster similar to that of fine chinaware.—S. Kramerich, Detroit, Mich.

Lower Portion of Screen Hinged So It Can Be Opened Easily

If the screens on your upstairs windows are held in place tightly with turn buttons, here is an easy way to hinge a portion of one so that it can be opened for shaking dust mops, etc. First cut the frame about 15 in. above the lower edge and attach

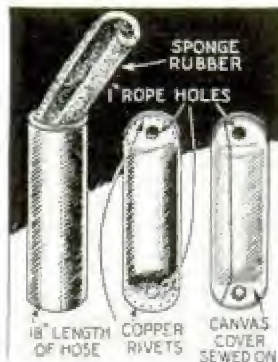


strap hinges as shown. A crossrail is then fitted between the two side members to provide rigidity and this is held in place securely with corrugated fasteners. Bradding a piece of molding to the crossrail keeps the screen from bulging.

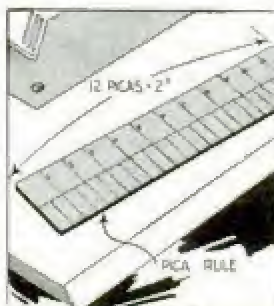
Neat Boat Fenders From Hose

Unusually neat fenders for a small boat can be made from lengths of large hose, preferably old fire hose. This is filled with tightly rolled sponge rubber, after which the ends are copper-riveted together.

A canvas cover for each fender improves its appearance and provides a good base for painting if desired.



Printer's Pica Gauge Is Handy When Making Scale Drawings



Craftsmen who have frequent occasions to make scale drawings before starting work on projects, will find a pica gauge (printers' rule) useful in drawing to a scale of 2 in. equals 1 ft. As

there are six picas to an inch on these gauges, each pica mark represents 1 in. or twelve of them represent 1 ft. Division marks between picas make it possible to use scales of 1 in. and 4 in. equal to 1 ft.

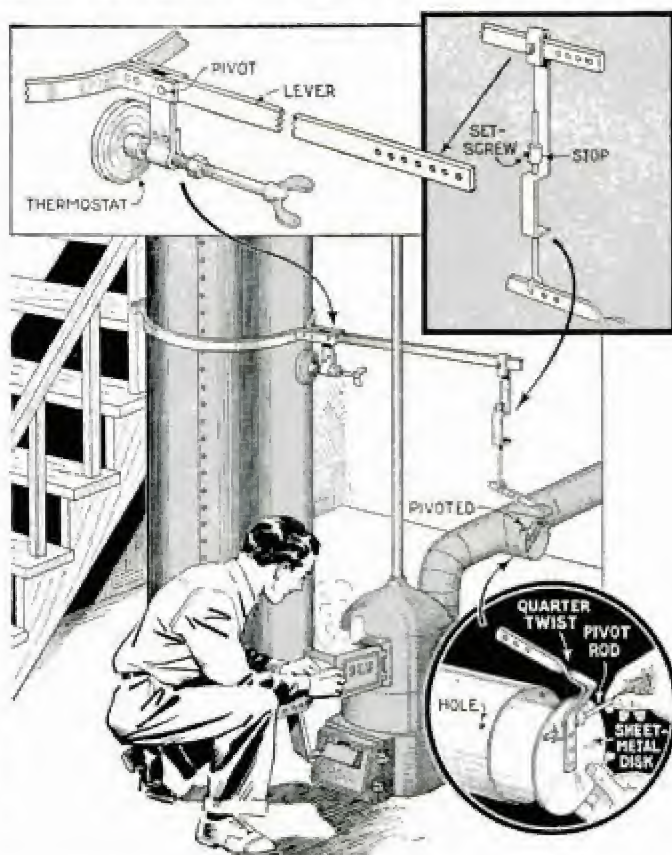
Clogged Sewer Cleaned Easily

After experiencing trouble by clogging of the main drain leading to the city sewer, I used a hose to clean it regularly. The clogging was caused by hair roots from trees growing into the joints of the drain pipe. By making a nozzle for the hose from a short piece of pipe, in which several small holes were drilled after plugging the end, the hose was inserted into the drain and the water turned on to flush it out.

—H. K. Carruthers, Ottawa, Ont., Can.

Thermostat Controls Draft in Hot-Water Heater

Costing less than one dollar to make, this automatic draft control for hot-water heaters of the coal-burning type not only keeps water at the proper temperature but it also eliminates the possibility of creating a dangerous pressure in the tank. To make it, first obtain a wafer-type thermostat and mount this on a lever pivoted to a flat-iron clamp that can be attached near the center of the tank. Then provide the stovepipe with a check draft having a pivoted flap and connect the two as shown. When a fire is started in the heater, the drafts remain open until the water in the tank is heated to the level of the thermostat. As the thermostat expands, the lever is raised, opening the check draft automatically. Being free to move inward, the flap will operate vigorously on windy days, adjusting itself to various conditions of draft in the chimney.—Leo A. Chartier, Danielson, Conn.



Cottage Partitions Extended by Panels Hinged to Rafters

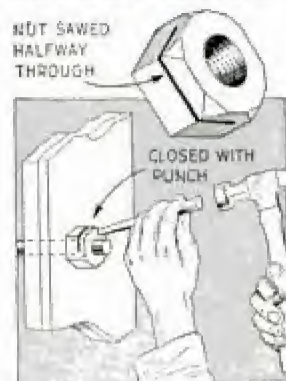
If sleeping rooms on the upper floor of your summer cottage are separated by low partitions which have proved annoying to occupants on account of lights and disturbing conversations from adjoining rooms,

here is an easy way to correct the trouble. Just-extend the partitions to the roof, using plywood or hard-pressed-board panels, hinged to the rafters. Being light, they can be opened with a rope-and-pulley arrangement for ventilation whenever necessary.—Paul Roth, Battle Creek, Mich.

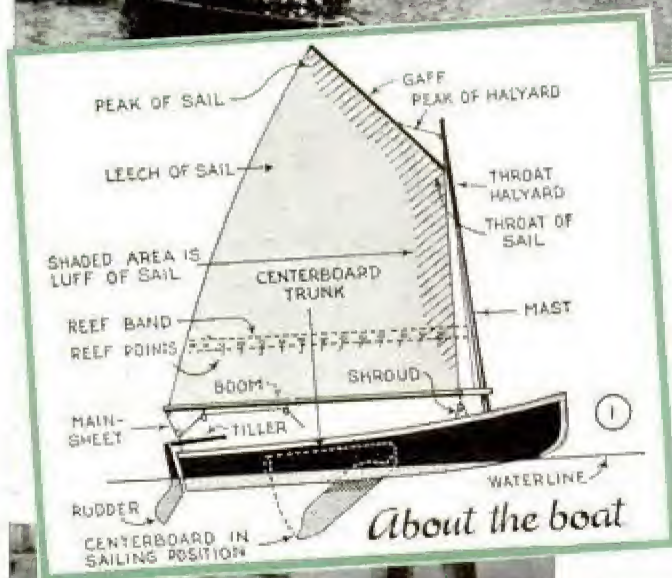


Nut Slotted to Lock It on Bolt

By slotting a nut as shown and then driving it on a bolt, it can be locked securely in place. To do this, simply close the slot with a punch. If the nut has to be removed later, open the slot with a chisel, holding a weight against the opposite side of the nut to avoid bending the bolt.—N. Bogoch, Winnipeg, Man., Can.



SMALL SAILBOATS



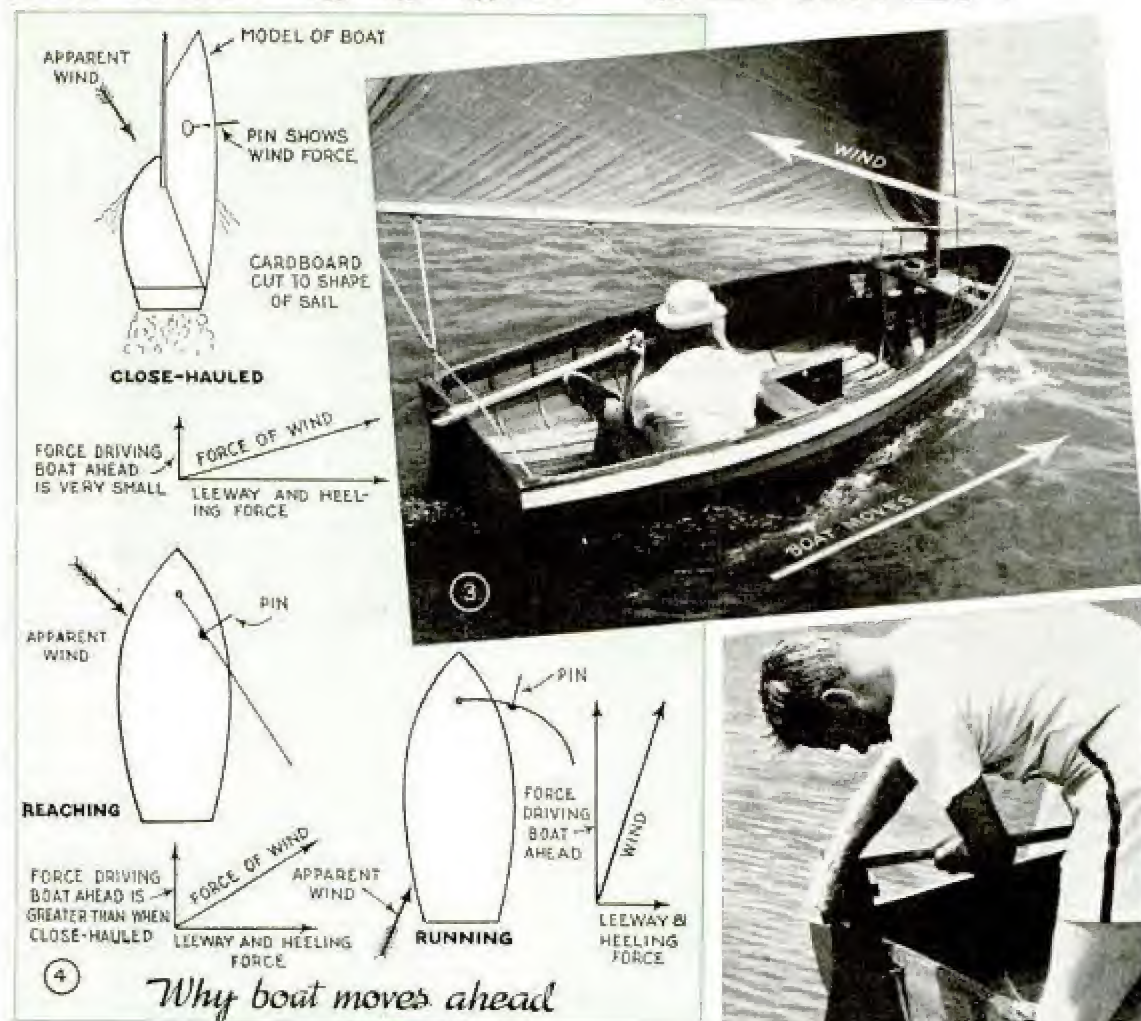
The three main points of sailing a small boat explained, as well as how to leave a mooring and return, meeting emergencies, etc.

SEAMANSHIP is doing the right thing quickly at the right time. Usually there is little time for careful thought and reasoning, thus making a seaman's actions more or less instinctive, based on repetition and thoroughly ingrained principles. Therefore, to handle a sailboat, one should understand how the action of the wind on the sail causes it to move

forward. For this purpose, the sail can be compared to an airplane wing. The force of the air striking the windward side of a sail is but a small fraction of the total force; like a wing, most of the force is developed by the leeward (away from the wind) side—upper side in the case of a wing. This force may be considered to be exerted at right angles to the plane of the sail, in the direction a pin would project if thrust through a sheet of paper cut like a sail, Fig. 4. The centerboard of a dinghy, and the keel of keel-type boats, tend to resist the side pressure, with the result that the boat moves ahead, Fig. 3. Just as an airplane wing loses its lifting action when the angle of the wing with the wind becomes too great, so does a boat sail lose its driv-

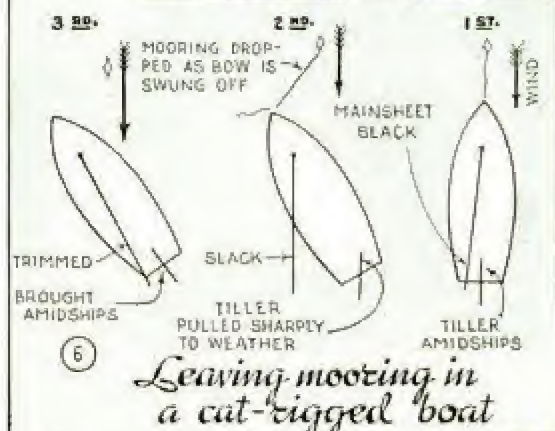


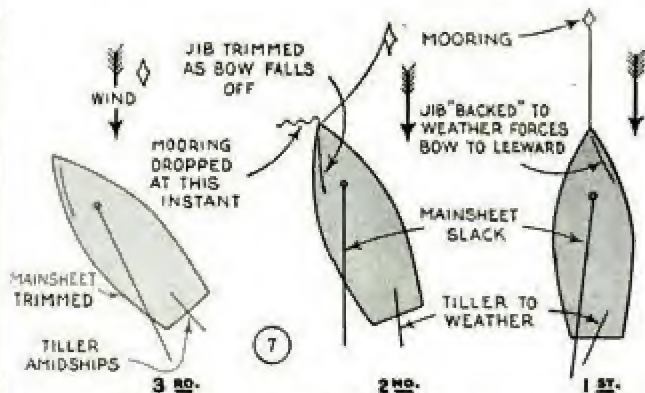
MAKE GOOD SEAMEN



ing force when its angle becomes too great. A sail is then said to be trimmed too hard.

Getting the boat ready: As the cat-rigged dinghy is one of the most popular and rapidly growing classes of boats, we will use it in our sailing test. First, the mast must be stepped; that is, dropped through the hole in the forward thwart and into its step. Then the shrouds, one to a side, are set up as Fig. 2, with the lanyard running through an eye in the shroud to give added purchase. The shrouds should be equally taut so that the mast is not pulled in either direction. Then the rudder is stepped, Fig. 5, and a cotter pin is inserted to keep the rudder from jumping off in a seaway (motion of the waves). Next, the sail is hoisted, setting the luff just hand taut so that when the breeze fills it there will be no wrinkles. You can learn the various parts of a sail and boat by referring to Fig. 1. Now, the boat is launched and the centerboard is lowered.

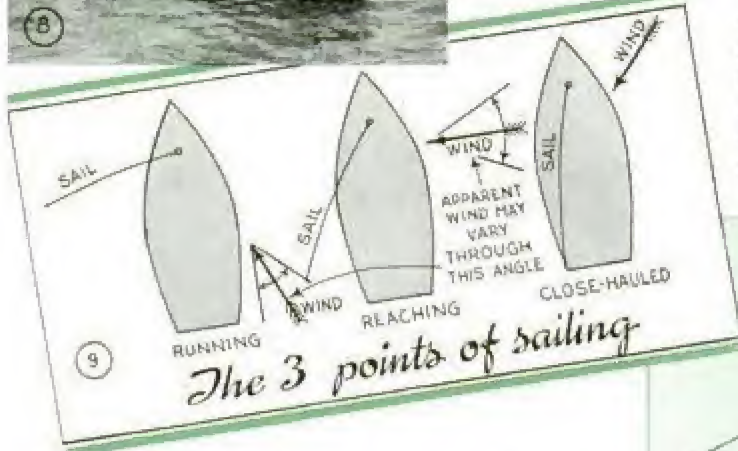




Leaving mooring in a jib-and-mainsail boat

from the wind). Hoist the sails with the mainsheet slack. Then unfasten the painter and trim the sail. If the boat is on the windward side of the dock, a smart shove will carry it clear as the sail is trimmed.

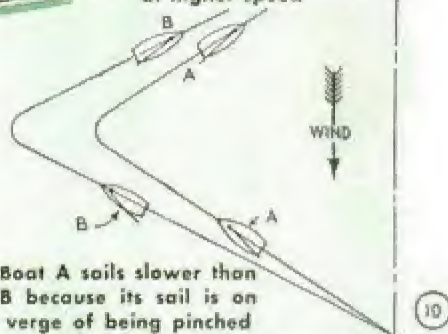
The "points" of sailing: There are three "points" of sailing: close-hauled, reaching and running, each referring to the direction of the wind in relation to that of the boat, Fig. 9. Close-hauled is difficult since



Leaving the mooring: As it is easier to take a boat away from a mooring than from a dock, this will be done first. When moored the boat lies head to the wind as in Fig. 6. A sharp pull on the tiller will swing the bow off in the desired direction, after which the sheet (a rope used to control a sail) is trimmed (taken in) until the sail is at the proper angle and the boat moves ahead. When it is on the desired course the tiller is brought amidships (to the center). With a boat having mainsail and jib, the procedure is different in that the pull of the jib can be used to turn the boat from head to wind, Fig. 7. The mainsheet must remain slack during this maneuver, otherwise the force of the mainsail will counteract that of the jib.

Leaving the dock: Leaving a dock is easy if the boat is to leeward (on the side away

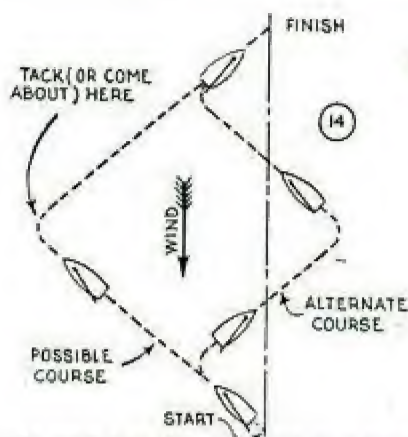
A good seaman must decide whether to sail a shorter course A at slower speed or a longer course B at higher speed



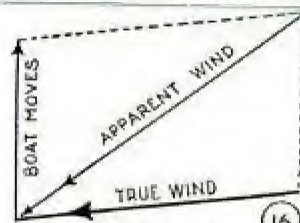
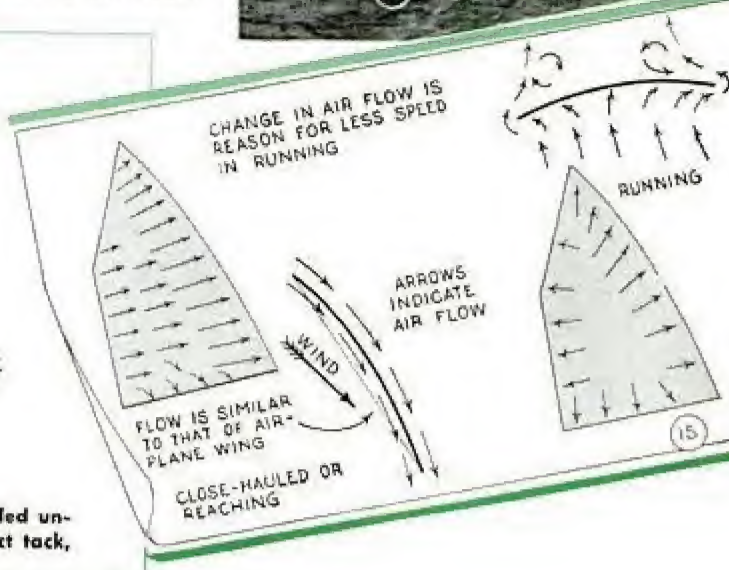


you must decide whether to point higher (closer to the wind) and travel a shorter course at a slower speed, or to sail a bit fuller (slightly farther from the wind) and travel a longer course at a faster speed, Fig. 10. This is important as it is by tacking, Fig. 14, that a boat sails to a point directly to windward. To sail a boat close-hauled, trim the mainsheet until the boom is over the leeward corner of the transom, Fig. 11, and ease the boat into the wind by moving the tiller slightly to leeward.

Use a telltale (wind direction indicator), so placed that it can be watched constantly. Several strips of colored silk ribbon, $\frac{1}{4}$ in. wide,

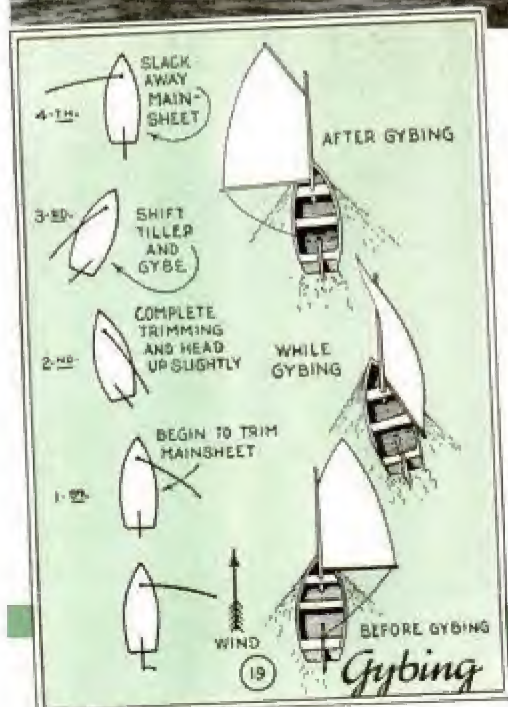
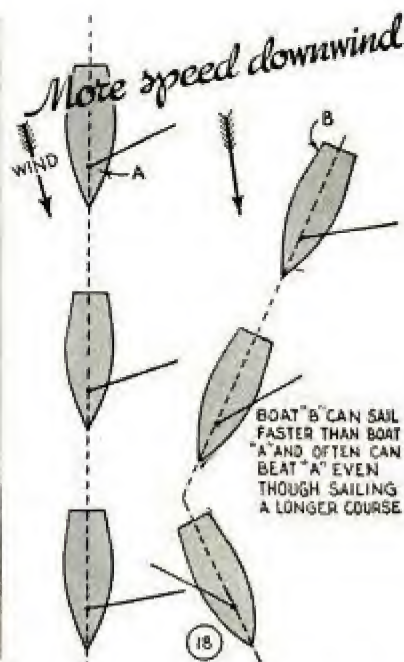


To work into the wind, sail close-hauled until finish point can be reached on next tack, or tack several times



*To estimate
apparent wind*

on a 2 or 3-ft. length of bamboo that can be fastened to the end of the gaff is excellent, Fig. 8. The telltale shows the apparent wind, which is the true wind as it is changed to the sailor by the boat's motion. A boat sails on the apparent wind—never on the true wind. In sailing close-hauled, keep the upper portion of the sail almost parallel with the telltale ribbons. The twisting of the sail is normal and helps drive the boat in light air when the wind close to the water's surface is retarded.

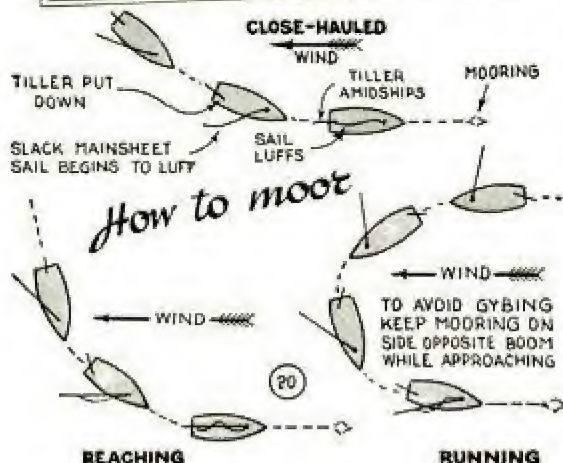


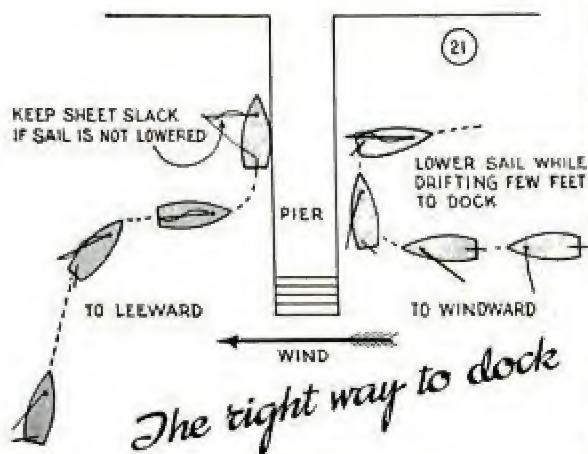
Reaching: In reaching, the boat sails more or less across the wind, Fig. 9. To change from sailing close-hauled to reaching, move the tiller up (toward the wind). Then as the boat's head falls off to leeward, slack the mainsheet. Fig. 12 shows how your dinghy looks now. Fig. 13 shows a Snipe class boat sailing on a reach.

Running: This is least exciting as the boat's speed is usually reduced and the apparent wind is much lighter. Fig. 16 shows how to estimate the apparent wind when the direction and the speed of the other is known, and the boat's speed can be estimated. To change from reaching to running, bring the tiller up slightly and pay out (slack away) the sheet. As you do this, the angle of heel is reduced, and the wind flows outward over all edges of the sail, Fig. 15. If the wind is very light, even small boats find it advantageous to tack downwind, Fig. 18.

While the maneuver called gybing (turning with the wind) is much used and is essential to sailing, an unexpected gybe can cause a lot of trouble. Guard against a sudden gybe by keeping close watch on the telltale; when the ribbons show that the wind is dead astern, bring the boat a few degrees into the wind. Gybing, Fig. 19, is more difficult than tacking as the mainsheet must be taken in very quickly, especially in stronger breezes, as the helm is put up. Fig. 17 shows two Star class boats; the left boat is about to gybe around a mark, while the right boat has just completed a gybe.

Mooring or docking: The methods of picking up a mooring from the three points





of sailing are shown in Fig. 20. Remember that the distance a boat will headreach (be carried forward into the wind) will vary with different conditions of speed and sea. When approaching a dock from leeward the task is simple. Merely headreach up to the dock, moor, and drop the sails. To land at the windward side of a dock, a small boat can be sailed directly downwind, Fig. 21, and then swung into the wind with a hard-over tiller. The hard-over rudder acts as a brake and the boat is almost dead in the water about a boat length away from the dock. By the time the sail has been lowered, the boat has drifted within reach.

Meeting emergencies: Three types of emergencies may be met in sailing a small boat. These are strong winds, hard squalls, and man overboard. Strong winds require a reefed (reduced in size) mainsail. On a small lake or bay where there is no possibility of being blown far from land, it is often wise to lower canvas on the approach of a squall that promises to be severe. In a jib-and-main-sail rig, the jib can be left standing. A small-keel boat or a centerboard boat with excellent stability can be luffed through a squall. This means that the mainsail is allowed to luff very markedly, as in Fig. 22. Practice picking up a man from the water by dropping overboard any object that will float, and then rounding back to it just as if you were coming up to a mooring, as in Fig. 23. Try to bring the object alongside



at the moment when speed is much reduced when it would be easy to assist a person. Nearly everyone that sails a boat sooner or later has occasion to assist a tired swimmer, and practice in all possible maneuvers is the only way to guarantee that it can be done quickly and correctly. When assisting a swimmer, it is a good idea to pass a line under his arms and support him in the water for a few minutes until he has rested sufficiently to assist himself before attempting to bring him aboard.

Clothespin Holder Hangs on Line And Eliminates Stooping



You won't have to stoop for clothespins on wash day, if they are kept in this holder. It consists of a tin can bolted to a length of flat iron having the top end bent to hook over the clothesline. Decalcomania transfers are used to decorate the holder after it has been given two coats of enamel.

—Robert M. Hughes, Long Beach, Calif.

Portable Shade for Field Workers

Where tedious work such as trimming small plants, slips and seedlings makes it necessary that the work progress at a slow pace, or that considerable time must be spent in a limited space, one nurseryman provides his workers with a portable shade. This not only protects the workmen against the sun but also prevents the immediate drying out of the plants. Two high cultivator wheels, supported by stub axles, provide one pair of supports for the light framework, over which is stretched thin

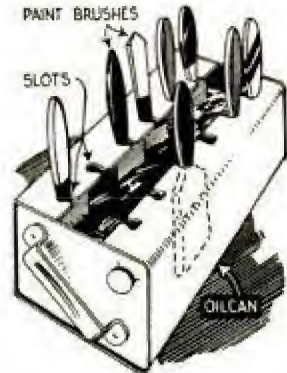


cloth. The supports at the other end of the shade consist of two rigidly braced legs, which are raised slightly when it is necessary for the shade to be moved.

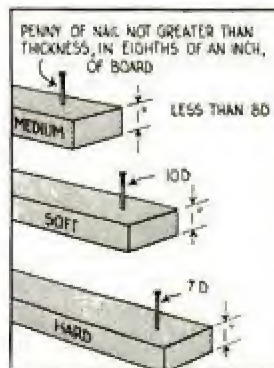
—Elton Sterrett, Houston, Texas.

Simple Container to Suspend Paint Brushes in Liquid

One painter keeps his brushes from drying out overnight by suspending the bristles in a can of liquid. An empty motor-oil can is used, and one side is slotted and notches cut in the edges to take the brush handles as shown. Such a container costs nothing and takes only a few minutes to make with a pair of tin snips.



Choosing the Correct Nail To Suit the Job

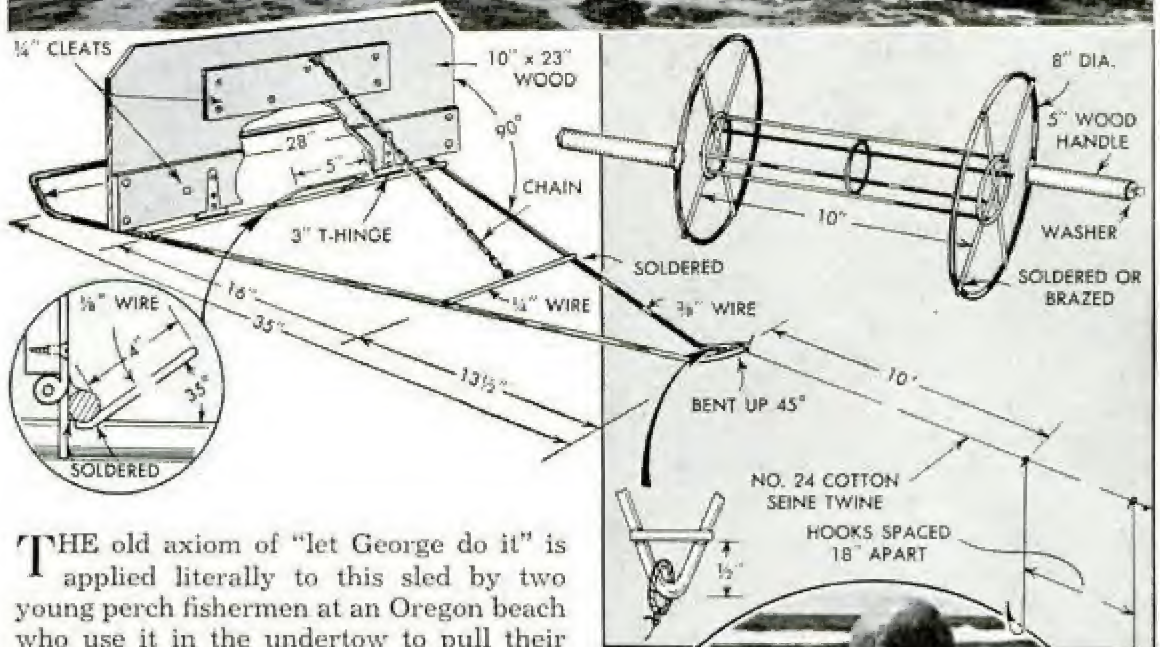


the thickness of the wood in eighths of an inch. In hardwood, the nail should be one penny smaller, while in very soft wood, the nail may be one or two penny larger.

In assembling work with nails, the importance of selecting those of the right size for the job should not be overlooked. When using box nails in wood of medium hardness, the penny of the nail should not be greater than the

Repairing Refrigerator Gasket

When the rubber gasket surrounding the door of a refrigerator seemed to lose its life and to half collapse, permitting outside air to seep into the box, a slight incision was made at the right-hand corner into the collapsed air cell. Then a length of single-strand drop cord wire was worked around the whole face, thus filling out the insulation and preventing the entry of warm air.



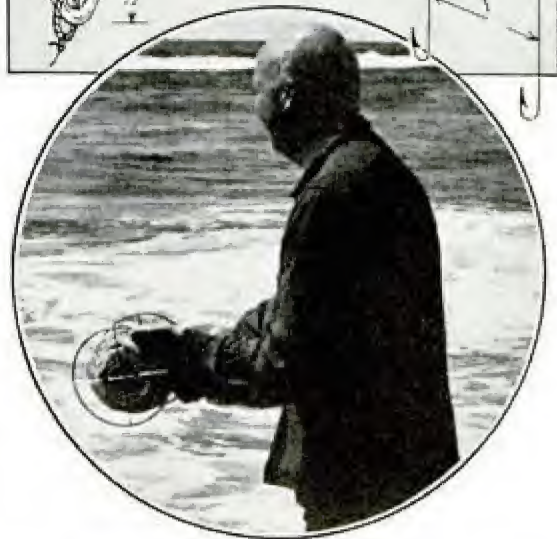
THE old axiom of "let George do it" is applied literally to this sled by two young perch fishermen at an Oregon beach who use it in the undertow to pull their line from the shore into deep water. The fishing line is tied to one end of the sled, which is placed in the water near the shore where it is 1 or 2 ft. deep. The undertow catches the pivoted flap and slowly moves the sled into deep water. The flap is pivoted with two hinges which are soldered to one of the cross braces. To prevent the sled from moving shoreward should it be caught by an incoming wave, the flap is hinged so that it will fold forward to an angle of 35 degrees where it is held by a wire support until the undertow again raises it to a vertical position, a light chain holding it in this position.

The sled is made from a length of heavy galvanized wire bent to a triangular shape and braced with three cross wires soldered in place. Bending up the ends of the sled at an angle of 45 degrees prevents it from catching on the bottom of the sea.

A reel for pulling in the line and sled at regular intervals is made of heavy wire

as indicated in the upper right-hand detail. The reel is fitted with two handles located at opposite sides of the reel ends for easy cranking action. However, any reel of suitable size and strength can be used instead if desired.

—R. Tarshis, Portland, Ore.



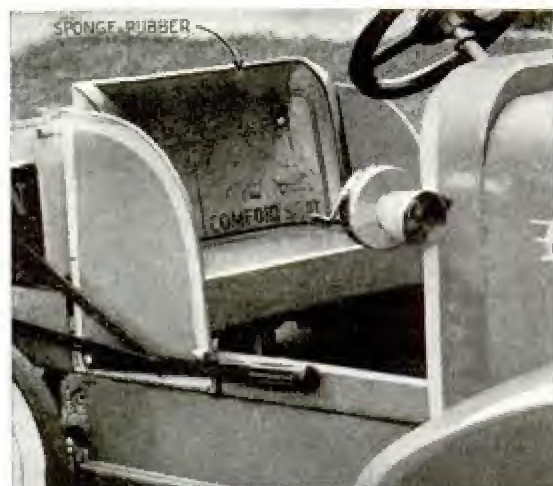
Car Axle Reinforces Gate Post And Provides Sturdy Hinge



Embedded in a concrete gate post as indicated, the front axle of an old car strengthens the post and provides a rigid support on which to pivot the gate. Before using the axle, it is bent at right angles at the ends, which project beyond the post. Bolts through the kingpin holes in the axle and the sockets in the gate pivot the latter.

Kneeling Pads Upholster Seat Of Junior's Sidewalk Auto

Upholstering the bucket-type seat of a sidewalk auto for comfort and safety of the young driver is an easy matter if you use sponge-rubber kneeling pads for the pur-



pose. As the corners are slightly rounded, a neat fit is obtained simply by fastening one on the back with a couple of round-headed stove bolts. Another pad could be used on the bottom of the seat to absorb shocks although two of them would be still better in simulating the comforts of modern cars.—Richard Kern, Belleville, Ill.

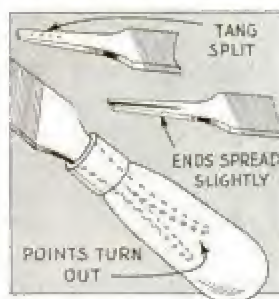
Sponge Rubber Cleans Triangle While Inking Drawings

Edges of triangles and other drawing instruments may be cleaned quickly merely by pulling them across a small piece of sponge rubber attached near the upper right-hand



corner of the drawing board. When a job is finished, the sponge should be removed and washed in warm water to remove ink.

Holding File in Wood Handle

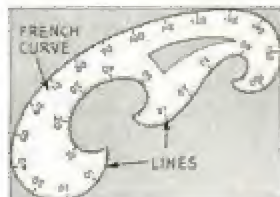


The next time you put a wood handle on a file, split the tang as indicated, and then drive the handle onto the file. The tang will spread slightly as it is driven on so

that it cannot loosen in use. The handle can be driven off with a hammer when file is worn out.—A. Waychoff, Phoenix, Ariz.

Scale on Edge of French Curve Aids in Duplicating Work

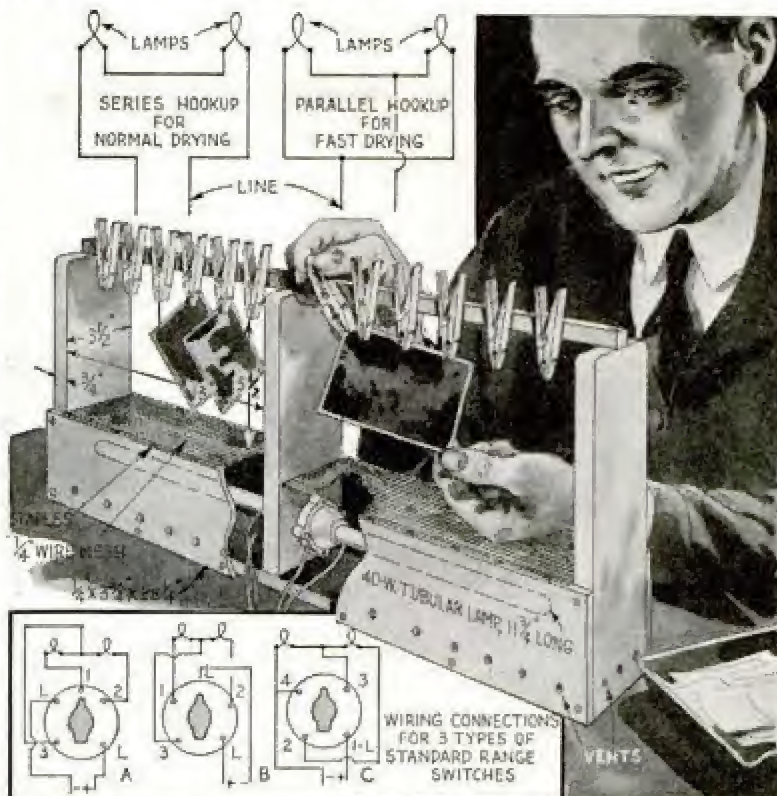
When you have a drawing that requires the making of duplicate curves, a scale on the edge of your French curve will



aid greatly in this work. Equally spaced lines are scored on the curve, then every tenth one is numbered. Ink applied to the scored lines makes them easy to see.

Photographic Dryer Heated by Tubular Lamps

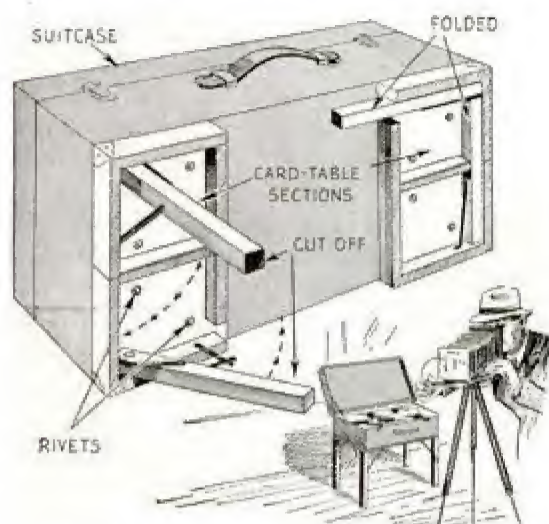
This low-heat negative dryer costs little to operate, is portable, and it can be placed in any room free of dust and drafts. If the two tubular lamps are controlled by a series-parallel switch, they can be operated in either a series or parallel circuit to produce a low or high heat. An electric-range switch will be found convenient for this purpose. Wiring connections for three varieties of this type of switch are given in details A, B and C. Plenty of vent holes should be provided in the lamp trough to get good air circulation. Coarse wire mesh to cover the trough will prevent negatives from dropping on the lamps.



Folding Legs Raise Camera Case to Convenient Height

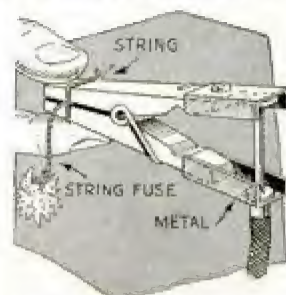
Folding legs on your camera-equipment case will serve a double purpose; they raise the case so that the contents may be reached easily without stooping and the case will be plainly visible so it will not be stepped on. The legs are obtained from an old card table, the four corners being sawed off, complete with the legs and folding mechanism, and riveted to the case. The

legs are sawed off to bring the case to a convenient height and the rails of the card table should be left long enough so that they butt together at the ends, for the sake of appearance.



Delayed-Action Shutter Release

Tripping the camera shutter when its string fuse burns down and releases a spring clothespin, this delayed-action release can be used on any camera equipped with a cable release. Two U-shaped pieces of sheet metal are screwed to the jaws of the clothespin, one being slotted to take the shank of the cable release. The opposite ends of the clothespin are tied together with a string, leaving one end long enough to serve as a fuse, its length determining the interval between the time it is lighted and the time the shutter is tripped.





PHOTOS *with* PEOPLE

By Thomas P. Lake



USING people in scenic pictures such as Fig. 1 not only suggests mood and gives scale, but also adds human interest. In doing this the photographer must use imagination, must be prepared for doing additional painstaking work, and he must be resourceful. For instance, in getting the photo of a child with a fawn, Fig. 2, it was found that the fawn was in the habit of feeding from a bottle. So, after getting a bottle, it was an easy matter to take the picture. If there are no persons available to serve as models, the photographer himself can get into the picture by using a delayed-action shutter or a long push-button cord with an electric synchronizer release.



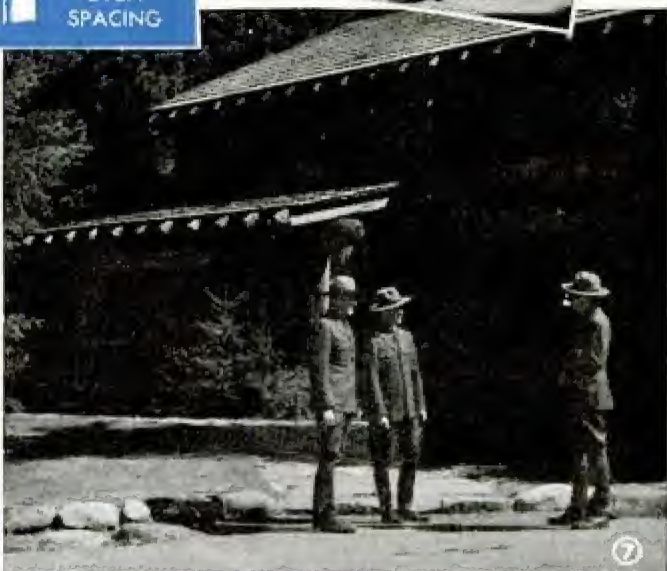
A subject such as Seattle's wishing well, Fig. 4, can be made interesting and its purpose emphasized by the way people are grouped about it as in Fig. 3. In this way the photographer can avoid stiff, obviously posed attitudes of models. When models are used, the first of five general rules is to pose them so that they seem to be unaware of the camera. The scene in Fig. 5 illustrates how the in-



terior view of an Indian canoe, uninteresting in itself, was obtained by tilting it and posing some of the people as though they were turning the canoe over to display it to a party of tourists.

Another example of simulated action—that of boarding a bus—is given in Fig. 6. The faces of the parents and child are outlined against contrasting darker tones. The stewardess was placed partly behind the woman to remove any suggestion of a “line-up” of the models. In such pictures as these, even spacing of the models should be avoided, which is the second rule in using people in photos.

Fig. 7 shows the headquarters of the Mount Rainier rangers. Such a picture can be taken by putting the camera on a tripod, setting the focus, shutter and diaphragm, and waiting patiently for action to occur. An exposure of 1/100 sec. will stop motion, especially if the exposure is made at a moment of suspended action. When photographing a distant view, you can call attention to the great range and distance by appropriate action as in Fig. 8, where one person is viewing the landscape through binoculars and another is pointing to the distant hills. The location of the camera was altered so that the sun struck diagonally





across the faces of the models, and in this way lively highlights and shadows were provided. One of the signs of good modeling of women in pictures is the way in which the feet are placed, good and poor poses being

shown at the right of Fig. 8.



In Fig. 10, the dummy compass card and the sighting vanes used in obtaining cross bearings of forest fires seemed to warrant a picture. An obliging ranger posed as if he were using the instrument, while the camera was again placed to show his face in sharp contrast with a dark portion of the window frame. A flashbulb to the right of the camera as shown in Fig. 11,

provided diagonal light, and was synchronized at $1/25$ sec. at a lens stop of $f:20$.

Pictures of homes are important in every photographer's collection. Too often, however, such pictures lack human interest. Even though the house is to be the important subject, put some figures in the foreground, as in Fig. 9. It is easy to avoid the impression of deliberate posing by giving the people something to do such as playing with the dog, picking flowers or raking leaves. This il-



lustrates the third rule when using models, which is that they should be subordinated to the subject of the picture. In this case the house was the main subject and the figures were placed far enough away from the camera so that their images would be small when compared to the house.

The picture in Fig. 13, showing climbers on Mount Rainier's Paradise Glacier, illustrates the

fourth important rule to remember when using figures in pictures, namely; when figures in a scene are moving or give the semblance of moving, they should move toward the center of the picture, not away from it. Also, this picture shows the use of people to give scale (relative size) to objects in the picture, in this case the fallen boulders and the crevasses. Avoid, if possible, having figures assume poses for which they are untrained. For example, it takes a good diver to look like a diver in the picture, although any normally graceful person in a bathing suit can take a relaxed pose like that shown in Fig. 12. When several figures are included in a scene, the majority should show a unity of interest by looking in the same direction or toward some single object within the picture. This is the fifth rule when using models. In Fig. 14 they are looking toward each other as if in conversation, which is the unity of interest.

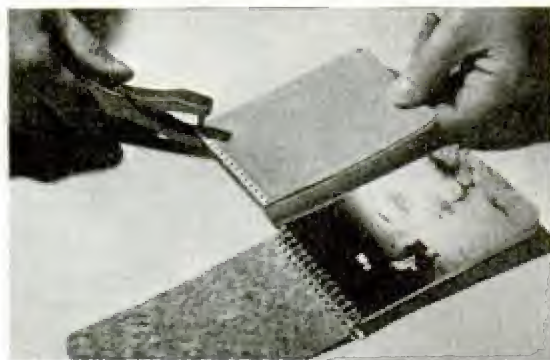
Observing these five rules will help you to make interesting pictures out of many subjects that might otherwise be somewhat dull and lifeless. Make a brief list of the five points and paste it in your notebook. Refer to the list frequently and soon you will find that you are following the rules automatically.



Keeping a Darkroom Dry

If your darkroom is located in the basement, where it becomes quite damp at certain times of the year, try setting two or three shallow pans of calcium chloride in different locations about the room. The chemical will absorb large quantities of moisture and in most cases will keep the room quite dry. When the calcium chloride becomes saturated with moisture, it is only necessary to place it in the oven for a few minutes. This will expel the moisture from it, after which it can be used again.

Snapshots in Spiral-Bound Book Are Easy to Carry in Pocket



Small photos can be bound in book form for convenience in carrying in the pocket or purse by making use of a five-cent spiral-bound notebook. To remove the wire binding from the notebook, release each end and turn it. Trim the prints to the correct size, then use one of the notebook sheets as a guide to punch the holes in them. Place the prints between the covers,

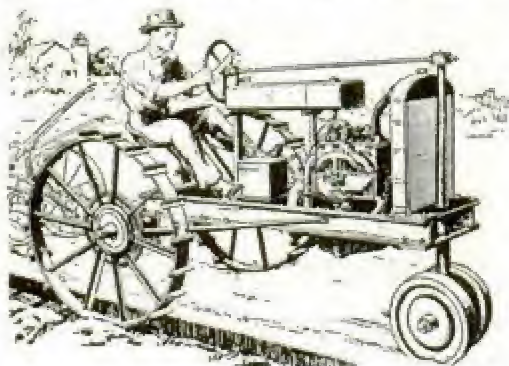
interleaving them with note-book pages if desired, and then you replace the wire spiral in its original position.

Wire Rack on the Darkroom Wall Holds Photographer's Bulbs

One or two of these handy racks on your darkroom wall will keep your photoflood and other bulbs out of the way and protect them from breakage. Make each rack from a length of heavy wire—that from a coat hanger is just right. Bend a small eye at each end for the fastening screws and bend the wire as indicated to form loops to hold the bulbs.



How to Build a Farm Tractor in Your Spare Time



Having plenty of power to pull a two-bottom plow and other implements, this farm tractor, built from old car parts, includes a Ford model-A motor and twin transmissions giving six speeds forward. Wrenches, hacksaw and drill are about the only tools needed—welding can be done at your local machine shop. Set of three 17 by 22-in. plans, Nos. 1024 to 1026 incl., containing construction details and material list will be sent postpaid upon receipt of 75c.

OTHER BUILD-IT-YOURSELF PLANS

STREAMLINE FAMILY TRAILER—937 to 942: Includes all the conveniences of home with sleeping accommodations for four. Trailer is 15 ft. long, weighs about 1,400 lbs. Six prints \$1.50.

UTILITY TRAILERS—986 and 987: Built of old auto parts and lumber. Adaptations of body to suit various purposes. Two prints 50c.

ELECTRIC ARC TORCH—106: Carbon electrodes $\frac{1}{8}$ in. dia. produce arc for soldering, brazing, light welding. For 110-v. 60-cycle a.c. 25c.

OUTDOOR FIREPLACES—917: Fine for preparing meals outdoors during hot weather. Several simple, but practical types, to match other items of a rack-garden setup. 25c.

LAWN CHAIR—1058: Can be built with hand tools from stock material. Curved, slatted seat assures comfort. 25c.

TRELLIS SUGGESTIONS—639: Shows construction of six different types that will help to beautify your home. One includes corner seat. 25c.

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LAWN CHAIR ON WHEELS—978: Light in weight and easy to wheel to any location. 25c.

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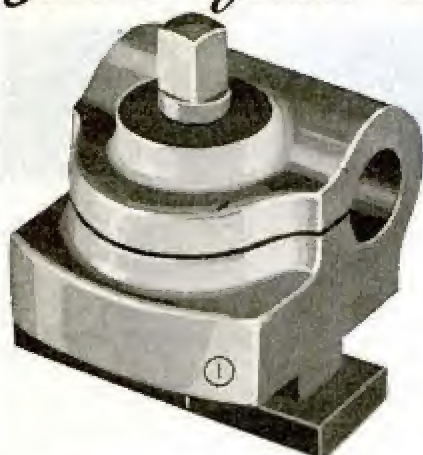
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Address Plan Service, Popular Mechanics Magazine, 200 E. Ontario St., Chicago, Ill.



SHOP NOTES

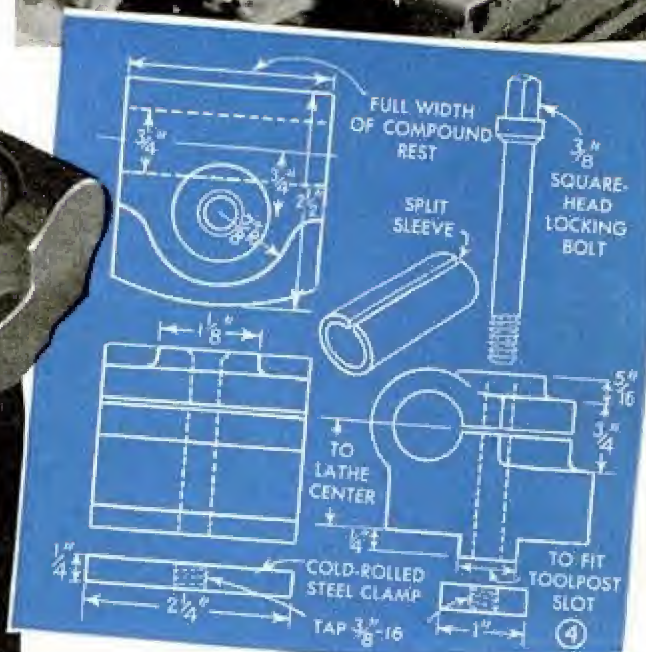
"Little Giant" BORING-BAR HOLDER



AFFORDING chatter-free rigidity to the overhanging cutting bit by extending the full width of the compound rest, this sturdy boring-bar holder will be found highly practical for all lathe boring, especially in making internal cuts where the tool must be advanced deep into the work. It consists mainly of a rough grey-iron



Make the pattern of white pine and seal the wood with several coats of shellac before having a grey-iron casting made from it like the one shown at the right

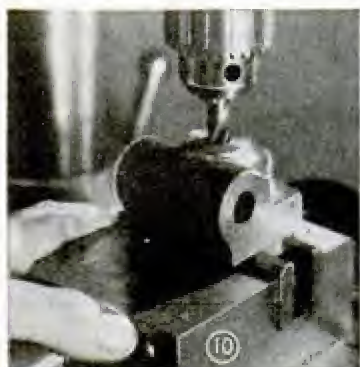
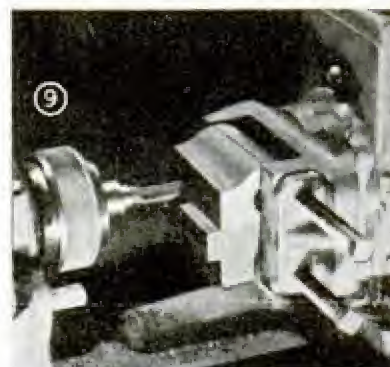




cut to the sizes given in Fig 4, sanded and glued together, after which the corners are made concave by molding a beeswax fillet along the joint with a hot rod as in Fig. 6. No thickness dimension is given for the base piece of the pattern as this is determined by the distance between the compound rest and the headstock center of the

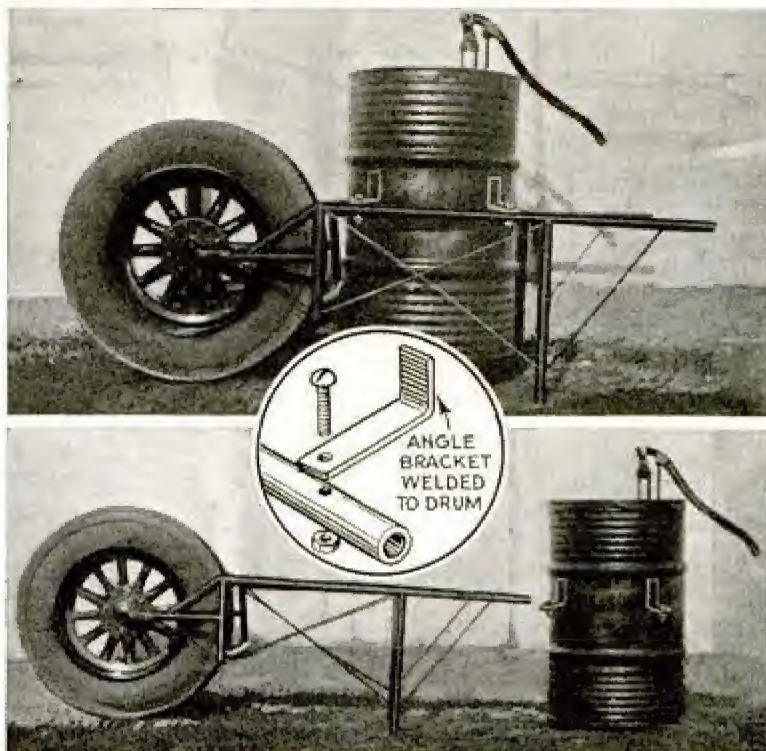
lathe at hand. After a coat or two of shellac is applied to seal the wood, the pattern is ready for the foundry.

Here's how you machine the casting. To obtain a true working surface from which other measurements can be marked, surface the base first by centering the work in a four-jaw chuck in the position shown in Fig. 5. Then locate and center-drill the hole for the boring bar and face the ends square with the base as in Fig. 7. Note that the tailstock center is advanced to engage the centering hole for support. While the work is chucked in this position, the hole for the boring bar can be drilled as in Fig. 8, or it can be done later when the holder is clamped in the compound rest. In the latter case the drill is chucked in the headstock and the work is fed to it by the carriage. Next, with the work held in a milling attachment as in Fig. 9, the base is rabbeted with an end mill to fit the tool-post slot, and then the hole for the locking bolt is drilled as in Fig. 10. Chamfer the top edge of the hole to seat the bolt head, which is turned to the shape indicated and then filed square to fit the tool-post wrench. Slitting the casting through to the boring-bar hole with a hack saw as in Fig. 11 completes the holder. Although it is dimensioned to take a $\frac{3}{4}$ -in. tool, smaller-size boring bars can be clamped in the holder by providing split sleeves to bush the hole.



Wheelbarrow Orchard Sprayer Uses Auto Wheel

In order to provide spraying equipment that could be used easily in restricted or congested places as well as on exceptionally rough ground, one farmer made this sprayer of the wheelbarrow type. The frame is of light steel tubing welded together and braced by small rods as indicated. The wheel is one from an old car, and the barrel is a 30-gal. oil drum on which is installed a hand-operated sprayer. Four angle brackets welded to the sides of the drum bolt to the frame to keep drum in place and make it easy to remove when necessary.—Edwin Kilburn, Spring Valley, Minn.



Metal Lath on Gangplank Provides Safe Place to Walk



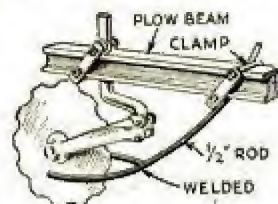
Any possibility of workmen slipping on a gangplank when pushing heavy loads up it, was avoided by one foreman who nailed strips of metal lath to it as shown. The strips were nailed in the center of the plank, leaving the sides unobstructed for the wheels of the trucks.

—G. E. Hendrickson, Argyle, Wis.

Colter Guards on Tractor Plow Ride Down Heavy Trash

Wishing to prevent his tractor gang plow from clogging in trashy fields, one farmer fitted curved guards ahead of the rolling colters.

Each guard is made from two lengths of $\frac{1}{2}$ -in. rod welded together so that they form a fork or "wishbone" with



one prong on each side of the colter blade. Accumulations of trash ahead of the plow are pressed down by the prongs so that the colter shears through them easily.

—W. C. Lammey, Downers Grove, Ill.

Inexpensive Crack Filler

To fill and make small cracks cover well on a surface to be painted with white enamel, I mix enough white enamel with 1 or 2 teaspoons of white flour to make it the consistency of face cream. When this is rubbed well into a crack and allowed to set, the crack will cover easily and completely. Also it will not let loose and fall out.—Fred L. Stocker, Ottumwa, Iowa.

Making CAR MOTORS



PLUGS LIKE THIS
ALLOW UNBURNED FUEL
TO WASH OIL OFF
CYLINDER WALLS

①



YOU can lengthen the life of your car motor considerably by simply giving it the care that any precision machine should have. Keeping it carefully adjusted at peak efficiency is highly important because if one part is not functioning at its best, other parts may be subjected to extra strain, causing them to break down much sooner than normally. Also, handling the motor properly while driving is important. Avoid racing a cold motor, let it warm up at a moderate speed for a few minutes to give the oil a chance to circulate, or drive slowly for the first half mile or so. And don't "give it the gun" when starting. Gaining two or three seconds time this way wears the motor as much as many miles of driving under normal speeds and conditions.

However, correct lubrication is the most important. A motor that is properly lubricated at all times will last almost indefinitely. This means more than merely keeping the crankcase filled. For long motor life, use only the best oil of the correct viscosity and change it at regular intervals, even though you may have an oil filter which strains out much of the foreign matter that collects in the oil. The reason is that corrosive acids, which result from combustion vapors, and sludge caused by the combining of various foreign matters, collect in the oil. These can be removed only by draining and flushing the crankcase.

The worst enemy of a motor is oil dilu-



②



③

RESTRICTED FUEL LINES CAUSE
HARD STARTING, WHICH RESULTS IN
OVER-CHOKING AND OIL DILUTION

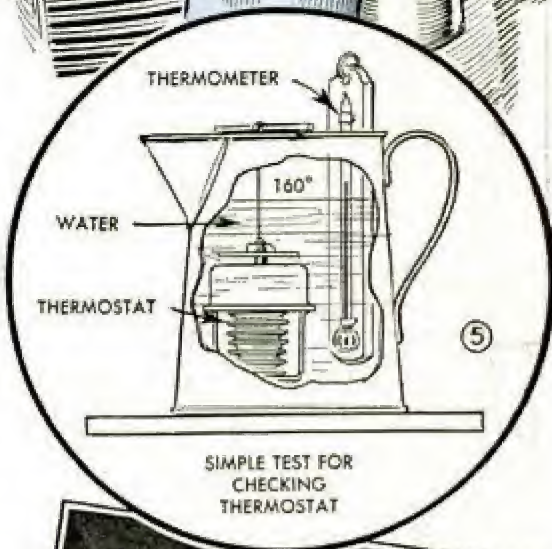
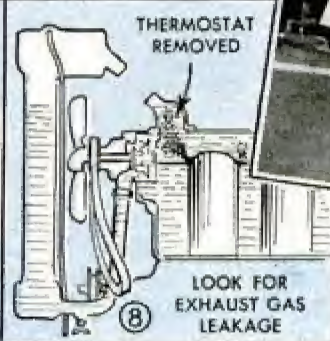
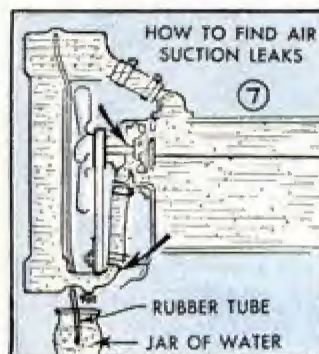


LAST LONGER



tion, which is the result of unburned fuel getting into the crankcase. Its causes are many, but the motorist who drives carefully and keeps the motor in good condition so that it will start easily and warm up quickly, can eliminate most of them. Oil dilution resulting from faulty motor operation may lead directly to the condition of parts shown in Fig. 12. These are not worn out, but each has been ruined by lack of lubrication. Carbon washed down by gasoline has caused the piston rings to stick, lack of oil of sufficient body has permitted the pistons to become scored, and acid in the oil has caused piston and wrist-pin corrosion. Burnt valves were the result of sticky, gummy sludge being thrown onto the valve stems.

When a motor is hard to start, you are likely to over-choke it, with the result that unburned fuel passes by the pistons, washing lubricant from the cylinder walls and diluting the oil. Likewise, a motor that warms up slowly means that an excessive amount of gasoline must be used to keep the motor running, and some of it, when striking the cold cylinder walls, condenses and results in still more dilution.





In most cases, hard starting is caused by faulty ignition. For example, look at the spark plugs in Fig. 1. The one on the left is clean, has the electrodes correctly spaced and delivers a hot spark. But the one on the right is so dirty and choked that, while it may fire, the spark will be weak and the fuel charge will be partly burned, the unburned fuel helping to dilute the oil. After cleaning and adjusting the plugs, remove one of the wires and hold it about $\frac{3}{8}$ in. from a cylinder-head bolt while the motor is running, Fig. 6. A good spark will jump to the bolt. If it is weak, check further. Look at the distributor points to see if they are bright, free of pits, and are adjusted correctly. Then go over the wiring. Clean and tighten all the connections and replace

wires having broken or frayed insulation. Don't forget the battery and its cables. If the source of the spark is weak, naturally you can't expect a strong one. Clean the battery posts, and be sure that the ground cable is making good contact at the grounded end.

If the ignition check has failed to improve starting, go over the fuel system. Look for a filter bowl near the fuel pump or carburetor, Fig. 2, and clean it thoroughly. In addition to this, there may be an unseen screen filter that needs cleaning. The one in Fig. 3, which is located at the carburetor, should be washed or blown out at regular intervals. Sometimes the carburetor float level, Fig. 9, is set too low and this may result in hard starting and excessive use of the choke. A level that is too high causes a wastefully rich mixture, with its resultant oil dilution, while a level that is too low reduces power and causes difficult starting.

Sometimes automatic chokes, Figs. 10 and 11, slip out of adjustment and cause starting troubles. They should be checked occasionally to see if they are in the fully-choked position when the motor is cold, and in the fully-opened position when the motor is hot. Usually these chokes are controlled thermostatically, and direct the exhaust gases against the intake manifold to assist in the vaporization of the incoming fuel. On some cars, the controls are eliminated and the gases are by-passed around the intake manifold near the carburetor. On this type, check to see if the by-passes are partly or completely clogged with carbon, which would interfere with proper fuel heating.

To further avoid oil dilution, be sure that the motor warms up quickly. If it doesn't,

check over the cooling system. Remove the thermostat, Fig. 4, and clean it, being sure that it is not stuck. Then check it in hot water as in Fig. 5. Those designed for high-temperature operation with permanent anti-freeze solutions should begin to open at 150 to 160 degrees. Others should open between 140 and 150 degrees.

Remember too, that overheating will shorten the life of a motor just as quickly as hard starting or slow warming up. It causes the oil to thin out, expands the metal of moving parts and reduces their recommended clearances, which results in rapid wear. In some severe cases of overheating, the motor block may even crack as shown in Fig. 13. Mild overheating may result from too rich a fuel mixture, or incorrectly timed valves and ignition. But generally it is caused by loosened particles of corrosion accumulating in either the radiator or the motor block. Use of an inhibitor in the radiator will help prevent rust, and using either pure rain water or distilled water will aid in reducing lime accumulations.

Looseness of hose connections, or water-pump bearings may permit air to be drawn into the cooling system at the point indicated in Fig. 7. This trapped air accelerates rusting and increases the bulk of the coolant, resulting in loss through the overflow. A check for air leaks is made by connecting a rubber tube to the lower end of the radiator overflow pipe, and immersing the tube in a jar of water. Then, with the radiator filler cap on tight and the motor running at a fairly high speed, a check is made to see if air bubbles are forced down into the jar of water. Bubbles indicate air leaks in the cooling system.

An equally bad condition is seen in Fig. 8 where a leaky cylinder-head gasket is allowing gases to escape from the combustion chamber into the coolant. Such gases contain sulphur, which unites with the coolant and produces sulphuric acid. In time, this may accumulate to a point where the coolant becomes highly corrosive. If such a condition is suspected, the thermostat should be removed and the cooling liquid adjusted to the level shown, with the upper hose removed. Then, if there is any leakage, sudden "gunning" of the motor will force combustion gas into the coolant. This test should be made quickly before boiling begins, or the resulting steam will cause confusion in the test.

Red Reflectors Under Trunk Lid Are Safety Measure at Night

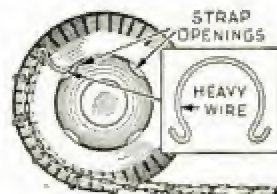


Several red reflectors mounted on the underside of a trunk lid will flash a warning to a motorist approaching you while unloading your trunk at night. This idea is especially handy if you frequently have to open the trunk on congested streets or heavily traveled highways where there is a possibility that a driver will not see you.

Easy Way to Attach Skid Chains Without Jacking Up Car

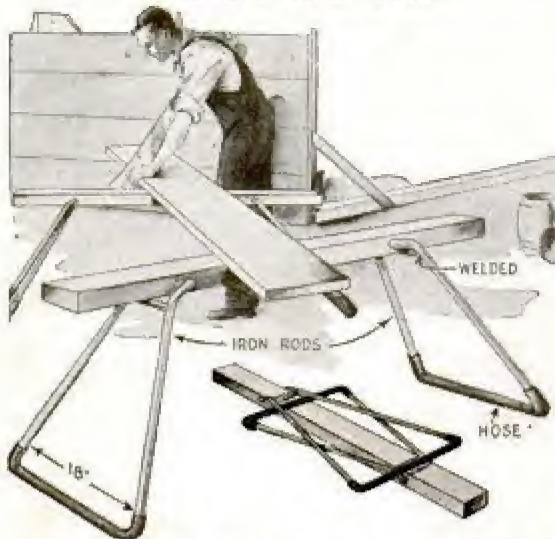
A piece of heavy wire bent as shown with hooks formed on the ends provides a handy tool for attaching skid chains without jacking up the wheels.

Just insert the wire in one of the chain-strap openings of the wheel and hook the end of the chain to it. Then stretch the chain out behind the wheel and back the car onto it until the two ends of the chain meet. Now hook them together and the job is finished.



Accidents caused by passengers stepping out of a cab into the path of moving traffic are avoided by one large cab company which removes all left rear door handles.

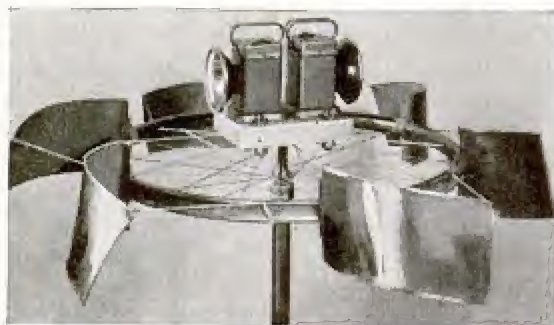
Portable Sawhorses Fold Flat When Not in Use



Carpenters who find it necessary to transport their tools from one job to another in a regular auto trunk will find these sawhorses just the thing as they fold flat when not in use and occupy little space. The tops are cut from 2 by 4-in. stock, after which holes are bored in the sides to accommodate folding legs, the latter being made of pipe or iron rods, bent to the shape indicated. Short lengths of garden hose slipped over each pair of legs prevent slipping on smooth surfaces, while cross braces welded in place near the top keep them from opening too far.

Beacons Protect Grain Fields From Migrating Ducks

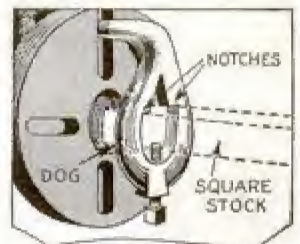
According to the Bureau of Biological Survey, grain fields can be effectively protected against migrating ducks by operating simple frightening devices of the type shown for about an hour after sunset and an hour before sunrise. These are made easily by bolting six curved sheet-metal reflectors on a bicycle wheel. Two electric lanterns are then fastened, back to back,



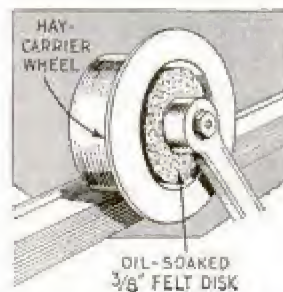
on a hardwood block in the center of the wheel which is mounted on a 6½-ft. length of pipe driven in the ground. When well lubricated, the beacons will rotate in the slightest breeze, resulting in flashes which frighten the ducks at night. In daytime, the reflectors alone were found to offer complete protection. To protect fields that are more than 1,200 ft. wide, several beacons will be required.

Notches Cut in Eye of Lathe Dog Adapt It for Square Stock

Sometimes it is handier to drive square stock in a metal-turning lathe by using a dog instead of a chuck. Any dog suited for round work can be made to hold square stock by filing two small notches in the position shown. In most small dogs, several sizes of squares can be held in one pair of notches.



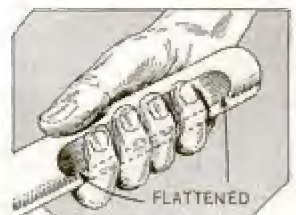
Hay Carrier Lubricated Easily With Felt Disks

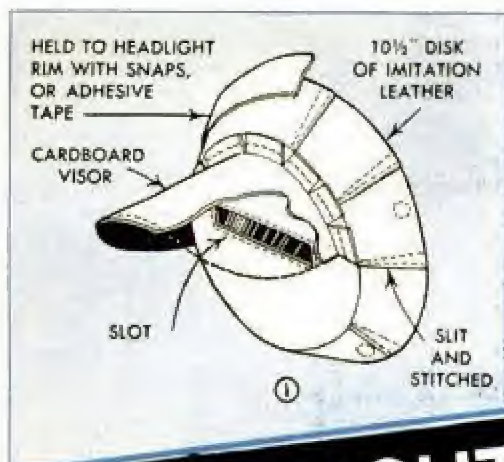


To keep the wheels of the hay carrier in his barn well lubricated, one farmer fitted felt disks to the wheels as shown. Soaking the disks with oil once each year is sufficient to keep the wheels well lubricated for an entire season's use.

Shovel Handle Flattened at End To Prevent Twisting in Hands

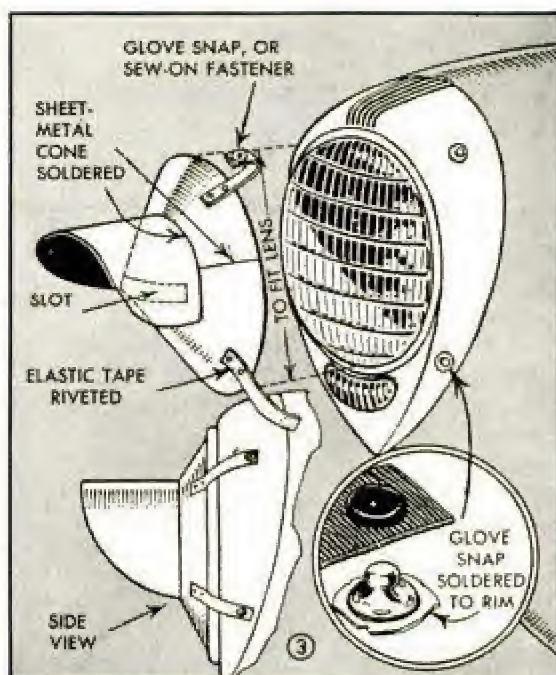
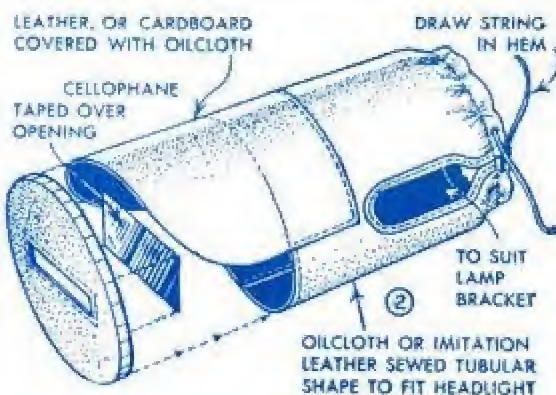
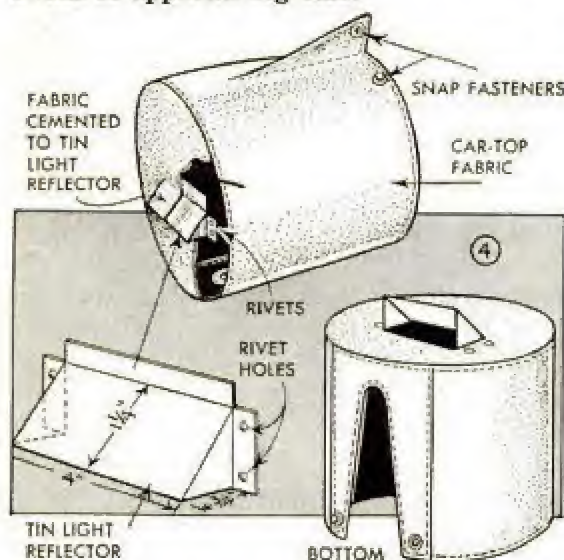
The tendency of a long-handled shovel, hoe or pitchfork to twist in the hands, thus tiring the finger muscles because of the necessary tight grip, can be avoided by flattening one side of the handle near the end. The flattened portion enables you to maintain a firm grip without undue strain.

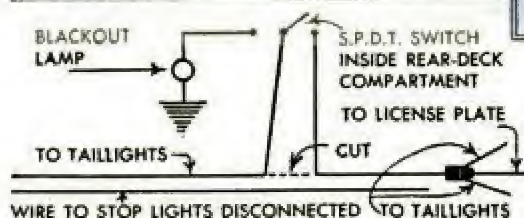
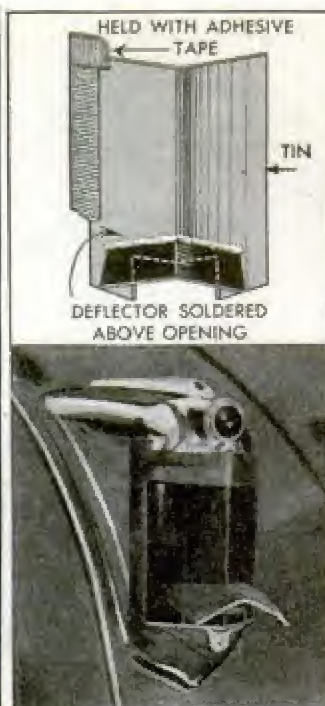
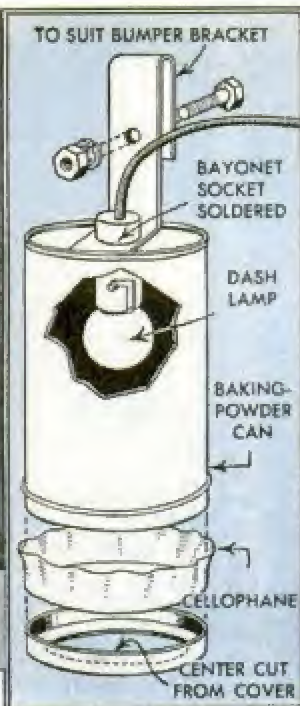




CAR-LIGHT BLACKOUT

AS DRIVING during a blackout is highly hazardous, all vehicles except essential ones should be parked at once at the side of the road not less than 25 ft. from a fire hydrant or from a street intersection, and the lights should be turned off at once for the duration of the blackout. If, however, your duties are such that they fully justify continuing to your destination, the lights of your car should be fitted with quickly attached blackout hoods, after which you can proceed slowly and with special caution. The hoods eliminate almost all road illumination and therefore they are of very little benefit to the drivers; their chief purpose is to warn pedestrians of approaching cars.





(5) Taillights can be blacked out from above yet continue to serve their usual purpose, or the taillights can be turned off entirely if a blackout lamp that throws light on the ground, is provided

Anyone can make either the slip-over hoods for the older type of headlights, or the snap-on hoods for fender-type lights. You can vary the construction and method of attachment as long as the lenses of the lamps are fully covered with an opaque material to shut off all light except that which is permitted to pass through horizontal slots about $\frac{1}{2}$ by 3 in. in size. These slots are shielded from above with visors so that the direct light cannot be seen at any angle greater than 12 degrees above the horizontal axis of the lamps. Thus only light reflected from the pavement will be visible to an observer above, and ordinarily this reflected light is not visible at an altitude over 400 feet.

The intensity of illumination from the headlights should be reduced with a few thicknesses of colored Cellophane, waxed paper or even translucent cloth, which is attached to the inside of the blackout hood to cover the slot. Blue Cellophane has been recommended for covering slots of headlight blackout hoods, on the erroneous assumption that blue light itself is less visible than other colored or white light of equal intensity. The purpose of covering

the slot with a translucent material is simply to cut down the intensity of illumination and therefore any colored Cellophane, waxed paper or similar material is satisfactory. However, general use of one color such as blue for blackout hoods on auto headlights has a value as a means of identification for pedestrians just as red is the customary color for taillights.

Fig. 1 shows an imitation leather or oilcloth hood for a fender-type headlight, the hood being attached with snap fasteners or simply with adhesive tape. A similar one of sheet metal is detailed in Fig. 3. Other hoods for headlights are shown in Figs. 2 and 4. Horizontal visors, curving downward at the sides, can be made of cardboard covered with oilcloth, imitation leather or other suitable waterproof material. They should extend far enough in front and the sides should be low enough to conceal light coming through the slot from any point over 12 degrees above horizontal. The hood in Fig. 4 has a small sheet-metal visor extending at an angle just over the slot.

Taillights can be masked by taping a piece of sheet metal or other waterproof material snugly over the lenses as shown in Fig. 5. A narrow portion at the bottom of the shield is cut away to permit passage

of light, and a small visor is provided above it. Any openings in the taillights for illuminating license plates, as well as any separate license-plate lights should be blacked out entirely with adhesive tape. As an alternative to using hoods on taillights, you can substitute a blackout lamp that throws light on the ground. A switch is provided to enable the driver to turn the taillights off and the blackout lamp on. The lamp itself consists of a small can fitted with a light of low intensity, and provided with a suitable hanger for attaching it to the car bumper.

Removing Tires From Safety Rims

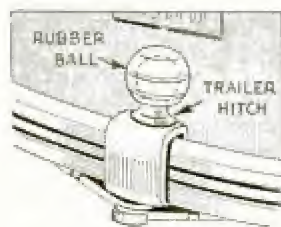
It is not such a difficult job to remove a tire from a safety rim if you go at it in the right way. Just stand with the heels on the tire at about the edge of the tread or



white side walls and roll the bead out of the safety groove. This cannot be done when the heel is placed too close to the edge of the wheel. By using this method of breaking the bead from the safety groove, you can remove the tire in just a few minutes.

—Chuck Phillips, Visalia, Calif.

Ball Shield for Trailer Hitch



If you have a ball-type trailer hitch on your car, it can be protected when not in use by using a hollow rubber ball. A hole is cut in the

ball so that it can be slipped over the hitch, making the hole of a size to be a tight fit so that the ball will not slip off easily.

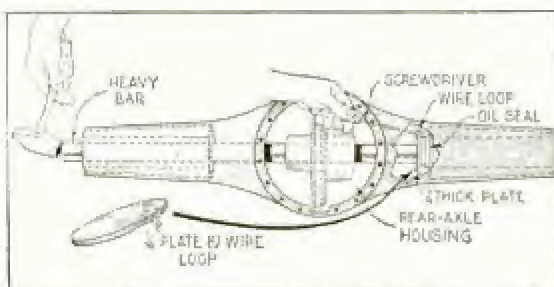
Oil on Frame of Garage Doors Prevents Them From Freezing



Have you ever had trouble with garage doors freezing shut after snow has melted and run down between the door and frame? If so, the trouble can be avoided by keeping the door edges and frame well oiled during freezing temperatures. Old crankcase oil is ideal for the purpose and may be applied with a paint brush.

Installing New Oil Seals

Here is a simple way of installing oil seals that will save considerable time as the differential-carrier assembly does not have to be removed. To do this, the rear axle shafts are removed, the grease drained and the cover plate taken from the differential housing. The old oil seals can now be removed easily with a heavy screw driver or pinch bar, which is hooked in back of them and bumped on the outside. Now, the new seal is pushed up in the axle-shaft tubing correctly, and a $\frac{1}{4}$ -in. steel plate a little larger than the seal is held in front of it by means of a long slim screw driver through a wire loop attached to the plate. Then, a long bar is pushed slowly up against the plate and struck a blow with the sledge hammer, forcing the seal into place.—Thomas L. Mino, Cincinnati, Ohio.



MACHINISTS for VICTORY !

Our men at the front are staking their all on the planes, tanks, guns and other mechanical equipment that the machinists and others at home must give their all to produce in this greatest, fastest and most important surge of industrial production in history! Not thousands, but millions of mechanics and machinists will meet this demand.

To make yourself an expert machinist, start now to get the knowledge it takes. First read these helpful articles on basic shop machines, of which this is the fourth, and then apply "full force" to studies in the work for which you are best qualified.

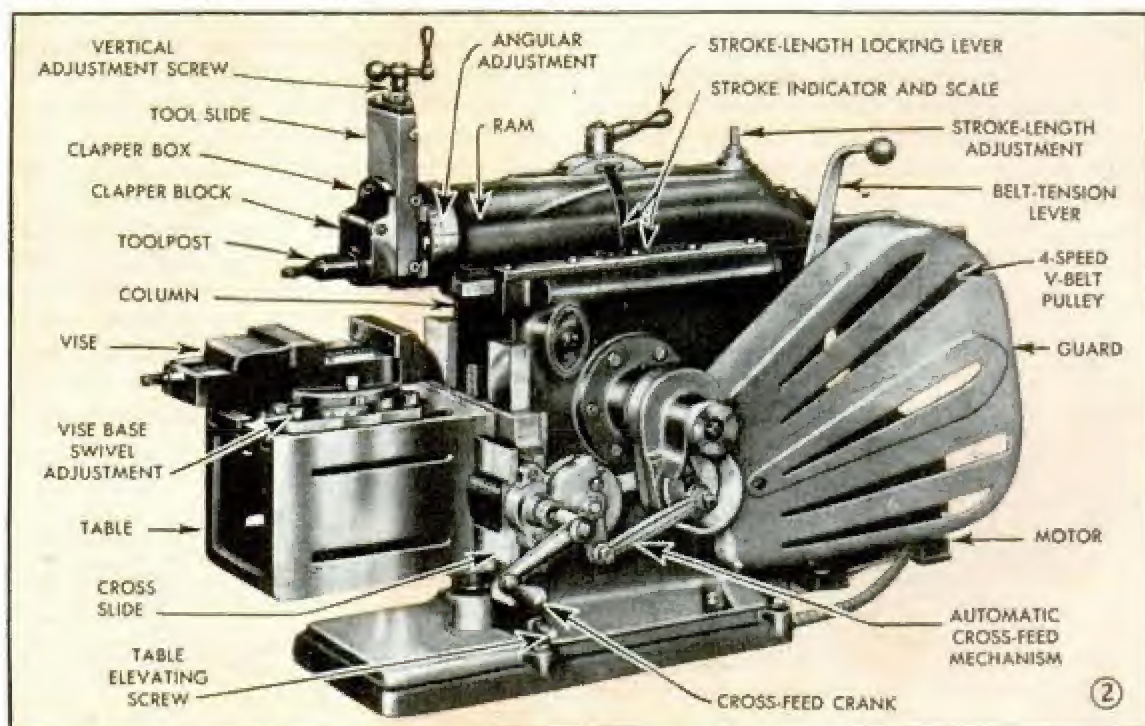
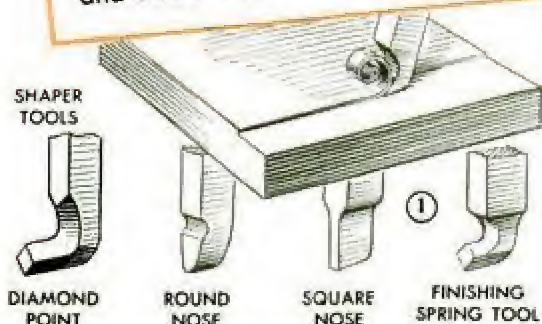
For your further studies, the Shop Notes Editor of Popular Mechanics Magazine will be glad to send you promptly a list of outstanding books on various machine-shop and allied subjects.

How to Use a

Part 4—By H. J. Chamberland

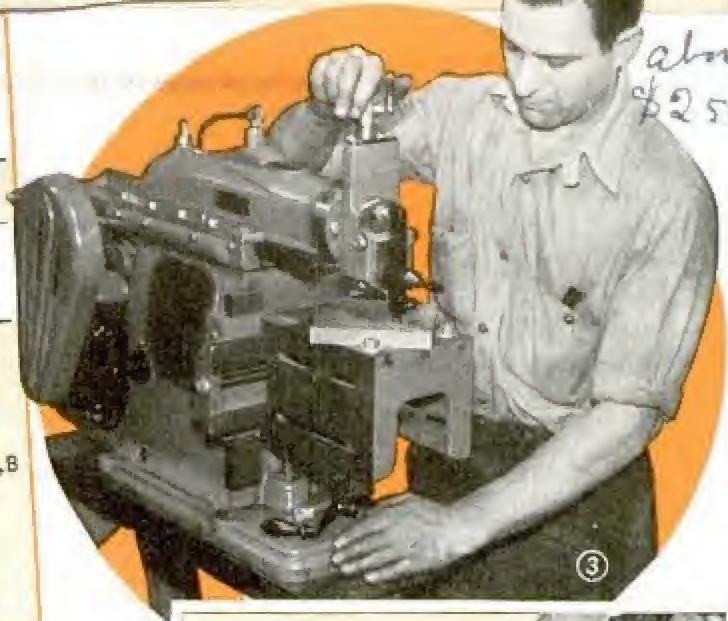
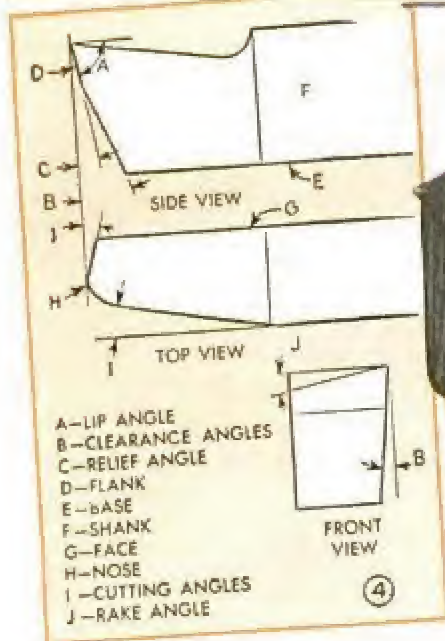
OF THE basic metal-working machines, the shaper is of importance as a means of chip-cutting metal, largely to produce flat surfaces. The manner in which metal is removed from the work, is much the same as it is in a lathe, but in a lathe the work rotates against the cutting tool, while in a shaper the tool travels back and forth, cutting the work on its forward stroke, the work being held securely on a stationary table. While a shaper resembles a planer in many respects, the fundamental difference between the two is that the table of a planer reciprocates instead of the tool as it does in a shaper. The

shaper is intended for small work whereas large work beyond the capacity of a shaper is handled on a planer. Belonging to the shaper family also are such tools as the nibbler, slotter, broaching machine and vertical shaper, Fig. 10, as they all produce chips by the stroke method. The broaching machine differs from the others in that it produces a shape or outline by a single stroke rather than by a series of strokes.



BENCH SHAPER

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How shaper works: Fig. 2 shows a modern bench shaper and gives the terminology of its parts. The work is clamped securely in a swivel vise on the table, or directly to the top or side of the table, which can be elevated and moved crosswise so that the work can be positioned in correct relation to the tool stroke. Traverse movement of the table can be controlled either manually with a cross-feed crank, or automatically with the cross-feed mechanism. A pivoted toolslide is attached to the end of the movable ram permitting it to be swung around to any angular adjustment; it can be fed slowly against the work with the crank at the upper end of the toolslide. The tool engages the work on its forward stroke but clears it on the return stroke due to the action of the clapper box. This action of clearing the work prevents rapid dulling of the tool point. With the bench shaper shown in Fig. 2, different speeds are obtained by using 4-step cone pulleys on the motor and on the drive shaft of the shaper mechanism. The rotating movement of the drive shaft is converted into reciprocating movement of the ram. The length of stroke can be varied by a simple adjustment, which can be locked. The capacity of a shaper is designated by its maximum amount of stroke, one having 7 in. being known as a 7-in. shaper. Indus-



In shaping the male part of a dovetail, a long, sharply pointed tool bit is needed for clearing the metal in the angular cut

trially used shapers are made in sizes up to 36-in. stroke capacity.

Few tools needed: As is the case with a lathe, the tools required for the average run of work on a shaper are few, and the beginner can start with the assortment shown in Fig. 1. Owing to increasing cost of high-speed steel and regulations to reduce the tungsten content of this steel from 18 to about 2 percent, tool bits are used in holders for the sake of maximum economy. Regarding relief, clearance and rake angles of the tools, Fig. 4, they are identical to lathe tool bits, except in certain cases where steeper and longer angles are necessary on shaper tools as in Fig. 5. Therefore the operator who knows how to grind lathe tool bits, can apply this knowledge to his work on a shaper. When the



tool-bit holder is clamped in the tool post, the distance from the tool post to the tip of the tool should be as short as possible, in order to assure the greatest possible rigidity and to prevent any tendency of the tool chattering on its forward stroke.

Mounting the work: Work that is mounted on a shaper table can be gripped in the vise, this being attached to the table and provided with a swivel so that the work can be swung around to any convenient angle for cutting. When cutting grooves or otherwise recessing in a line parallel to a flat surface of the work, this surface should be parallel to the top of the vise, which is ascertained easily by making a surface-gauge test for this purpose. It is good practice to insert pieces of cardboard between

the work and the vise jaws as this assures a uniform gripping surface when the vise is tightened properly. In case the work is of uniform thickness, but less than the depth of the vise, it should be placed on parallel bars set on the vise bed. Work that is too large to be held in the vise can be clamped directly on the table after removing the vise and its swivel base. When doing so one should always bear in mind that the positioning of the work should be such, if possible, that it will not have to be altered between successive operations. Various



Fig. 8 shows time-wasting method of drilling numerous holes to remove internal portions; this can be done on band saw in a fraction of the time

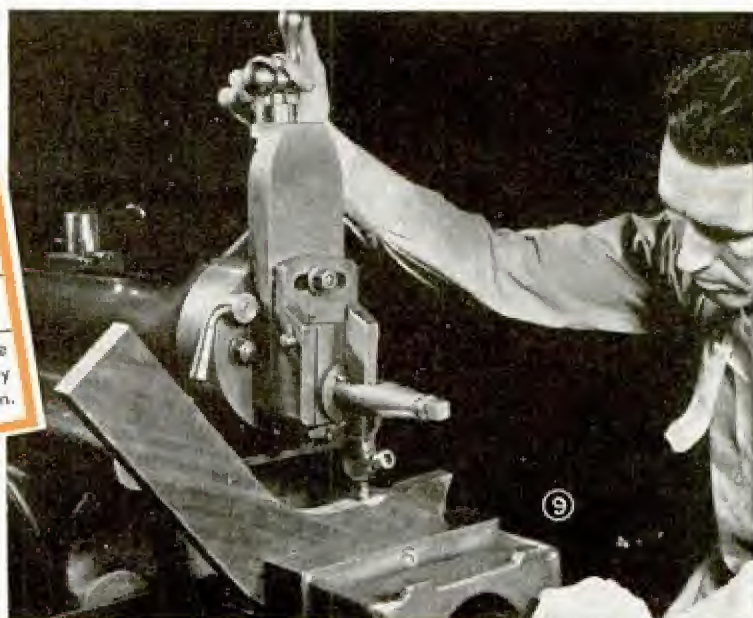
ways to clamp the work on the table are possible, making use of bolts to engage the slots of the table. In some cases counter-bored holes through the work enable the operator to bolt it down; sometimes step blocks and hold-downs are permissible. To prevent the work from sliding forward on the table from the pressure of the tool on its cutting stroke, a couple of short bolts with washers under the nuts are adjusted to contact the forward edge of the work and are then drawn tight on the table as is shown in Fig. 3. In this example the job included surfacing, squaring and V-cutting operations on a small cast-iron surface plate, which was drilled and counterbored in the center for bolting to the table. The

GENERAL SHAPER-SPEED
RECOMMENDATIONS
(In Ft. Per Min.)

Stock	Roughing	Finishing
Cast Iron	40-50	20-25
Tool Steel	30-35	15-20
Machinery Steel	40-50	25-30
Bronze or Brass	50-60	40-50

As number of strokes per minute are known, multiply this figure by length per stroke to find ft. per min.

V-shaped piece in Fig. 9, band-sawed out of large plate of rough stock, is set up on shaper for finishing cuts. Fig. 10 shows "business end" of a vertical shaper



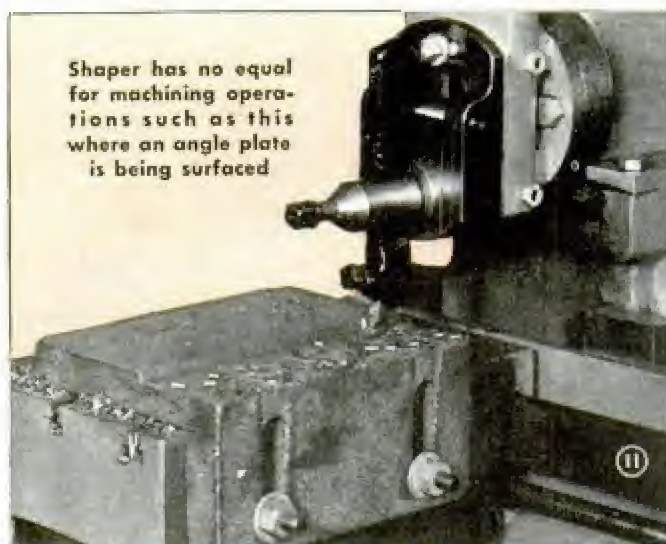
surface plate was 6 by 6 in. in size, the V-grooves $\frac{3}{16}$ in. wide and were spaced $\frac{1}{2}$ in. apart. After cutting the V-grooves in one direction, the bolt holding the plate down at its center was loosened, and, as the plate was perfectly square, it was merely given a quarter turn and pushed up against the washers on the stop bolts, after which the center bolt was retightened for cutting the second row of grooves at right angles to the first.

Shaper speeds and feeds: Similar to speeds and feeds when cutting with other chip-producing tools, the influencing factors in the case of the shaper are the kind of metal to be cut, the type of cut, whether a rough or a finishing cut, and also the rigidity of the entire outfit. The average bench shaper usually has four speeds, which give a range of 50 to 200 strokes per minute. As a general rule slow speeds are best on long cuts and vice versa. The table at the left of Fig. 9 gives recommendations for different materials when making rough or finishing cuts. The cutting speed is given in feet per minute but it is an easy matter to translate this into the number of strokes per minute simply by multiplying the figure in feet per minute by 12 to get inches per minute, after which you divide by the length of stroke to get number of strokes per minute. For instance, where 35 ft. per min. is recommended, and the strokes must be 6 in. long, you first multiply 35 by 12, which gives 420, and then divide this by 6, which gives you a speed of 70 strokes per minute. Accordingly, you adjust the shaper to 70 6-in. strokes per

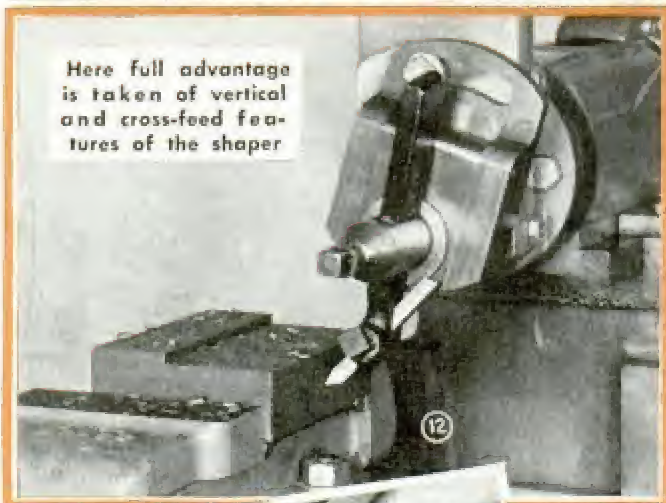


minute. The amount of metal removed per stroke is also variable and must be judged by experiment on the part of the operator. Apprentices should start with light cuts in order to become accustomed to the performance of the shaper.

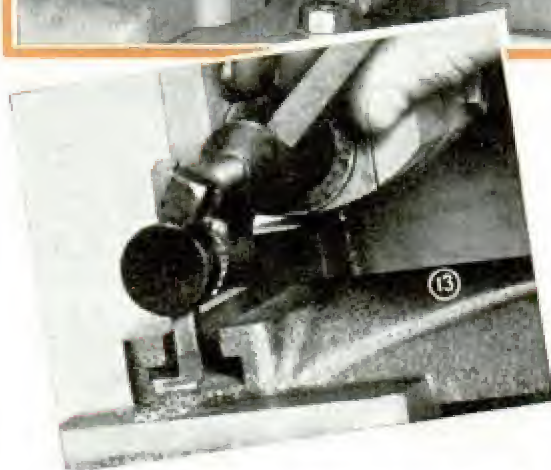
Saving time and material: As the shaper and planer, like other stroke-cutting machines, remove metal in practically worthless chips, it becomes a matter of great importance to pre-cut metal as closely to the approximate finish size by more economical means than wholesale removal of metal by chip production. Take for instance the work mounted in a shaper as shown in Fig. 9: This V-shaped piece was 2 in. thick, 15 in. long one way and 12 in. long the other way. Minimum waste of material and time in shaping was possible



Shaper has no equal for machining operations such as this where an angle plate is being surfaced



Here full advantage is taken of vertical and cross-feed features of the shaper



To cut a T-slot, the center section is grooved first; then the wider bottom portion is cut with a specially formed T-shaped bit

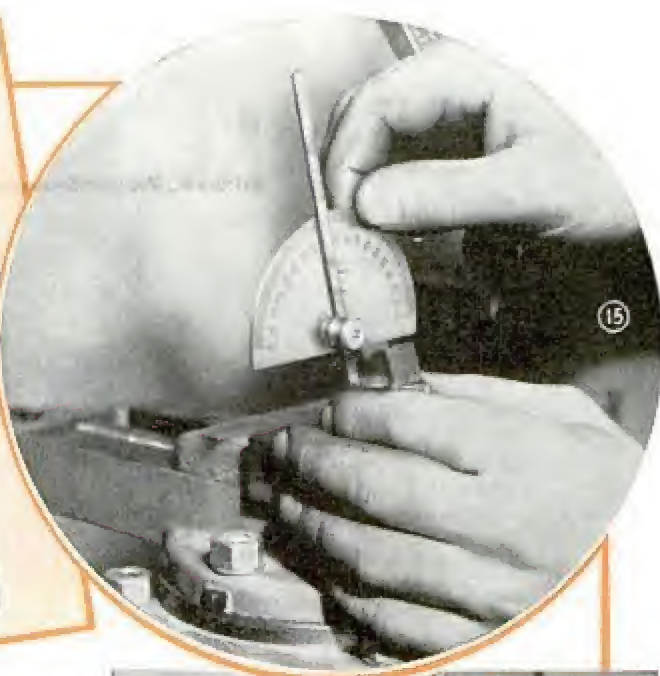
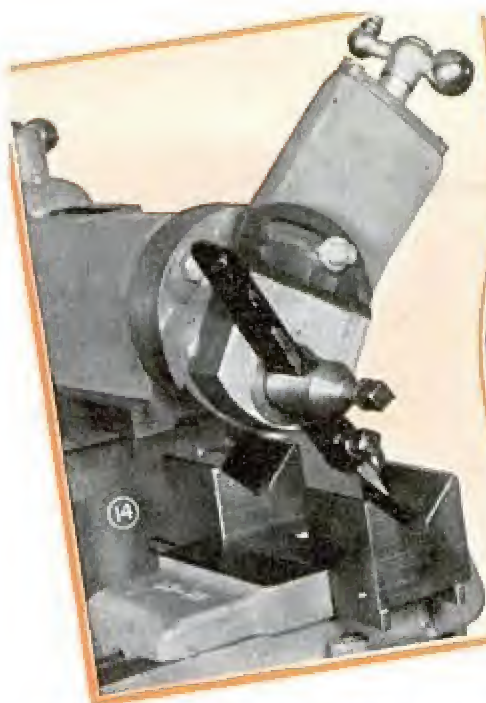
by first sawing out the V-shaped piece from a large plate of rough stock with a metal-cutting band saw as in Fig. 6. Even for cutting out internal pieces, the band saw is an ideal tool to use as the blade can be cut, inserted through a hole in the work, and spot-welded together again in a

few minutes, after which the internal cut can be made. Compare this method with the older, time-consuming practice of drilling a series of holes, preparatory to removing the internal piece, as shown in Fig. 8. Although the material waste is not great in this case, much valuable time is lost. Another method of cutting metal is to use an oxy-acetylene cutting torch as is shown in Fig. 7. While there is a considerable saving in time by this method, hard spots are likely to develop on the metal along the edges of the cut and unless these are annealed, the tool bit will be subject to a terrific "beating," when the metal is being cut on the shaper.

Work particularly suited to shaper: From the angle of economy, the shaper has no substitute for machining operations such as shown in Figs. 11 and 12. Note from Fig. 11 how convenient the table is to handle angle plates for surfacing operations. Fig. 12 shows how a piece is squared by taking advantage of the vertical and cross-feed features of the machine in one setting. Making dovetails in a variety of sizes to meet machine-tool requirements are familiar jobs on the shaper. When

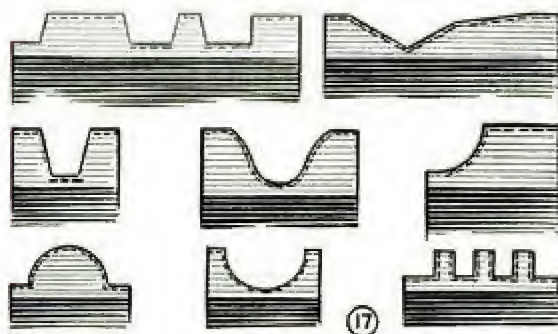
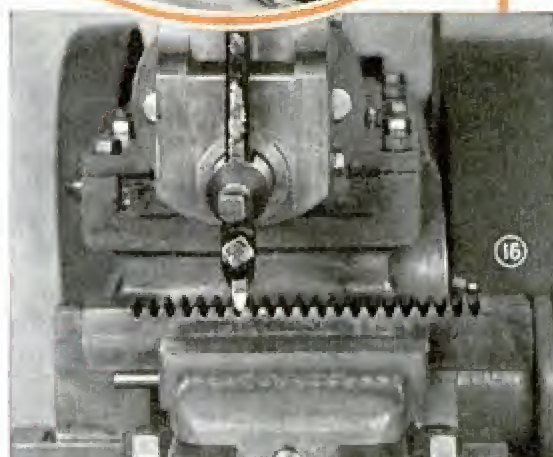
producing a rather limited quantity of dovetails, they are made in solid blocks or slabs of machinery or semi-steel, but where dovetails are produced constantly and in large volume, castings are used. Note in Fig. 5, which shows the male section of a dovetail being cut, that a long and sharply pointed tool bit is necessary in order to assure free-cutting action and to obtain square intersection of the horizontal and angular cuts. Another specialized shaper operation is shown in Fig. 13. This is a set-up for cutting a T-slot in a toolslide. In this case, the center section is cut first with a plain tool bit, after which the bottom of the slot is widened with a specially formed T-shaped bit as shown. On such current operations as dovetails and T-slots, full advantage should be taken of the micrometer adjustments for vertical and cross-feeds.

Making tools in the shaper: Bench-type and medium floor-type shapers play a



Cutting a pair of identical V-blocks in one operation is shown in Fig. 14. Fig. 15 shows checking clearance of grooving tool cut on shaper

prominent part in machine-shop practice of making a variety of tools. Such cutting tools as are used in lathes, boring mills, radial drills and automatic screw machines are made economically by a 95 percent roughing operation with small shapers. All one has to do is to work to within .010 or .015 in. of a template outline. Usually such tools are finished by hand filing, or if the surfaces must be extremely accurate, they may be finish-ground. Fig. 15 shows how a forming tool, which was cut on a shaper, is being checked for clearance with a protractor. In Fig. 16 a gauge that bears a great resemblance to a rack is being shaped. Although this demands strict accuracy it is not a complicated or difficult job to do on a small shaper. The tool bit must have its cutting section finished for the required toothlike shape. Each spacing is finished completely by a number of successively light cuts. Correct spacing of the grooves is easy to control by making proper use of the micrometer adjustment on the cross slide, and the depth of the cut is measured similarly with the micrometer adjustment on the toolslide. As V-blocks are generally used in pairs, cutting them on the shaper should be done in the same way as is shown in Fig. 14. This kind of work demonstrates the versatility of a shaper in its capacity to cut at compound



Strict accuracy is required for cutting racks or similar work as in Fig. 16. In Fig. 17 are some examples of forming tools cut on a shaper

angles without any disturbance in the mounting of the work. Fig. 17 shows cross-sectional views of a number of forming tools that can be produced with a bench shaper. Ordinarily these tools are made about 1 in. thick and are kept sharp by grinding the top only. Clearance

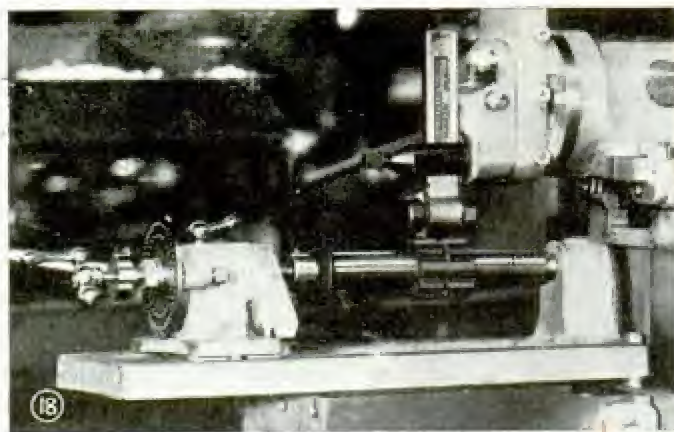


Fig. 18, a set of dividing centers on base plate bolted to shaper table for gear cutting and peripheral grooving

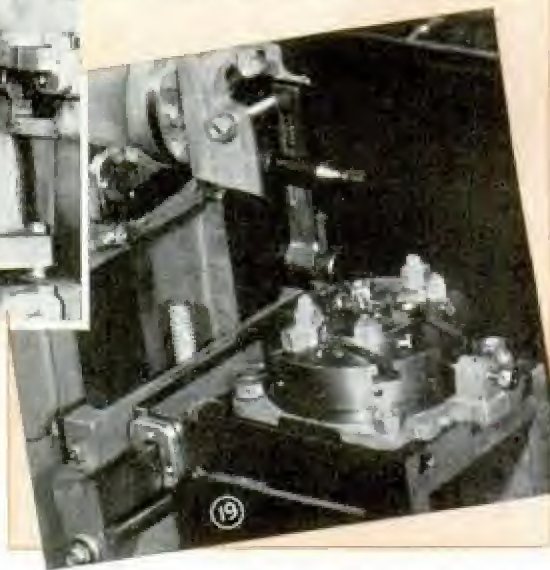


Fig. 19 shows indexing plate to cut on side of a turning

pend on the nature of the material to be formed. In Fig. 18, a set of dividing centers are fitted to a base plate, the whole assembly being bolted securely to the table of the shaper. This provides an accurate set-up to index the periphery of blanks when making gears, ratchet wheels, cutters and any other parts requiring evenly spaced divisions. Another similar attachment is shown in Fig. 19; a rotary indexing plate which is used to index on the side of a part instead of on its periphery.

Sometimes shaper operations seem to overlap those of a milling machine, and it is frequently a question which of these machines should be used to execute certain

jobs. After reading this article and the one in the next issue, which will deal with milling machines, the basic advantages of both machines should be clear to the average shop worker.

Next month—Milling Machine

Small Work Threaded Quickly by Using Die in a Lathe

On a job of threading four hundred $\frac{1}{4}$ -in. rods the slow, tiresome work of doing it by hand was avoided by using the die and stock in a lathe. One handle of the stock was mounted in the tool post so that the center of the die was exactly in line with the lathe centers and the body of the die stock at right angles to the lathe bed.

The carriage does not need to be engaged to the lead screw as once the thread is started, the thread itself will feed the carriage along. The lathe should be run at the slowest speed in back gear. When running off the die, time can be saved by switching over to the highest speed in back gear. Use plenty of cutting oil.

—C. C. Cooley, Wadesboro, N. C.



Removing Oil From Leather Belts

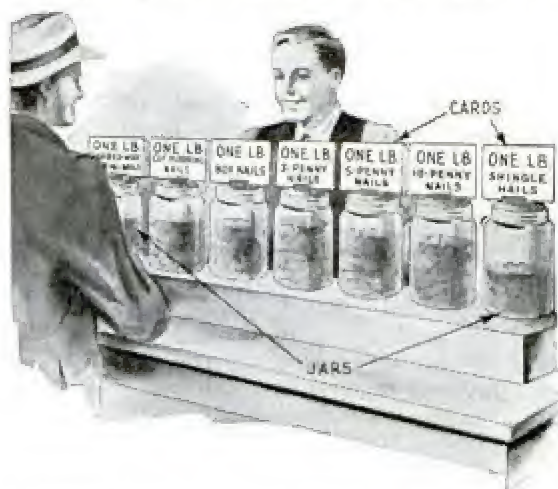
To clean oily leather belts, first scrape off the hardened grease that is visible. Then lay the belt on the floor and cover with a thick layer of fine, dry sawdust. After leaving the belt in this position overnight, remove the sawdust which will contain much of the oil, having soaked it up. Place the belt in a fairly warm room and cover with powdered chalk. Leave for several days. The capillary attraction will thus take up more oil and the belt will come out greatly improved.

This Portable Fence Requires No Holes for Posts

You won't have to dig post holes when putting in a temporary fence if supports of the type shown are used. These are assembled from native-sawed timbers and provide a portable fence that can be moved easily without loosening the wire. Such fences are especially handy when pasturing part of a meadow and it is desired to move the fence back occasionally to include more of the field. Chicken pens made by attaching the wire to supports of this type also may be moved quickly to new feeding grounds without driving or resetting posts.



Display on Store Counter Helps the Customers Select Nails



To help customers in their selection of proper size nails and quantities needed, one hardware store owner weighed a pound of each size and put them in fruit jars. The jar lids were then fitted with small cards to indicate sizes, so that customers can tell at a glance what size nail will be suitable for their purpose and about how many are in a pound.—Opie Read, Jr., Chicago.

Pressman Uses Apron as Pad

If your hips become sore from leaning against a job press on long printing runs, just roll your work apron as shown and secure it with a clothespin at each end. This provides a pad that will make the work much more comfortable.



Strengthening a Weak Magneto

After experiencing difficulty in starting a small gasoline engine, one farmer found that the trouble was caused by a weak magneto, which he repaired by using magnets from an old one. These magnets were large enough to slip over those on the engine magneto. In setting the larger magnets over the others, be sure the poles are placed to correspond with those on the regular magneto, otherwise they will tend to neutralize each other. Also measure the magnets to be sure they will slip over the others, as heating them will destroy the magnetism. In removing the magnets, loosen them without removing the armature and slip a piece of iron across the ends, as breaking the magnetic circuit even for a minute decreases their magnetism.

Possible Places to Conceal Key On Late Model Cars



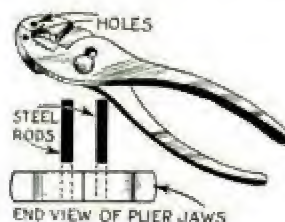
Have you ever lost your car key and had to have a mechanic either break or remove the door lock? If so, the photo shows a number of places where an extra key can be concealed on most cars. On some cars the bumper guards are so shaped as to provide a good place for a key, while on others it may be possible to store them inside of the tail lamp or the license-plate lamp. One of the lamps is preferable as it

offers good concealment and if no wrenches of any kind are at hand the key can be obtained by breaking out the lamp lens. Replacement of the lens, of course, will cost a few cents but it saves you a lot of inconvenience and is cheaper than having a mechanic break into the car for you.

—R. Boettinger, Englewood, N. J.

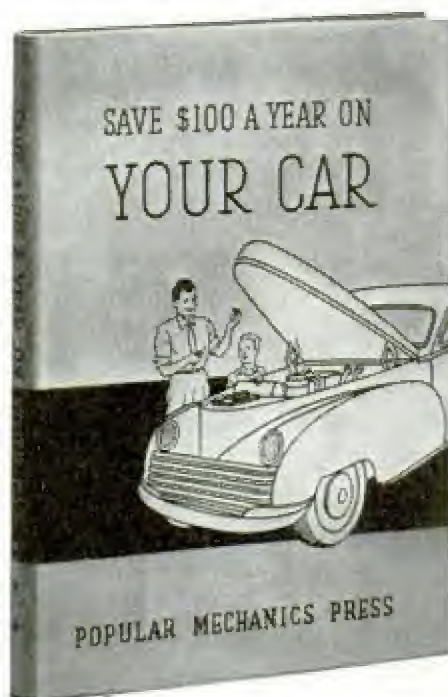
Tool to Repair Motorcycle Chain Made From Pair of Pliers

When a broken motorcycle drive chain has to be repaired, the difficulty of pulling the ends of the chain together for insertion of a connector link can be overcome by using a pair of pliers that have been altered as indicated. The jaws of the pliers are drilled to take a couple of steel pins, which are inserted into the end links of the chain after the latter has been put over the sprocket wheels.



—James Vick, Church Road, Va.

HOW TO MAKE YOUR CAR LAST LONGER



Tells how you can save money and still do your bit toward Victory, help conserve essential war materials and at the same time add thousands of miles to the life of your car. Popular Mechanics new automobile guide, "YOUR CAR," gives you hundreds of easy, practical kinks. Besides, it is filled with pictures and contains hundreds of time, money and labor-saving short cuts.

Would You Like to Know:

- How to double the life of your tires, as explained by experts?
- How to save money on your gas and oil?
- The secrets of picking a used car?
- How crankcase drainings can be put to practical use?
- How to cure electrical troubles?
- How to build and equip your own midget trailer?

All of these questions are simply and clearly answered in this thoroughly practical book, together with hundreds of others which you cannot possibly afford to miss. It has something for every driver, mechanic or garage man.

Order your copy today. Postpaid in U. S., \$1.25, or pay postman on delivery. Outside U. S. remit with order \$1.40. Your money refunded if you are not satisfied.

POPULAR MECHANICS PRESS, 200 E. Ontario Street, Dept. 391, Chicago, Ill.

RADIO



What to Do Before You Call the Radio Doctor

Part I

FIRST aid for home receivers is rapidly becoming a "must" for many set owners. All available radio servicemen are busy, and their ranks are being thinned by Army, Navy and production requirements. This means that there is a possibility that your receiver may "go dead" during an important broadcast and remain silent for some time, the length of time depending upon your ability to obtain service in your location, or your willingness to do a few simple things to help yourself.

This is the first of a series of practical "self help" articles de-



Each type of tube belongs in a certain socket, which must be clearly identified for that tube

signed to assist the readers of Popular Mechanics Magazine to keep their radio receivers in working order. Beginning with the average set owner who knows absolutely nothing about the internal "works" of his various home receivers, the series will gradually catch up with the more experienced amateur servicemen and radio experimenters who, with simple homemade test sets can go into some of the more serious problems of trouble shooting that can be solved without expensive equipment and advanced technical knowledge.

The upper photo shows Mr. and Mrs. Average Set Owner a few minutes after the family console receiver passed out. Unless there happened to be a radio station blackout at the time, it is quite possible that a tube finally reached the end of its useful life. At any rate that is a very common reason, and of course there are many others. Now if this happens to you, and it

(Continued to page 181)

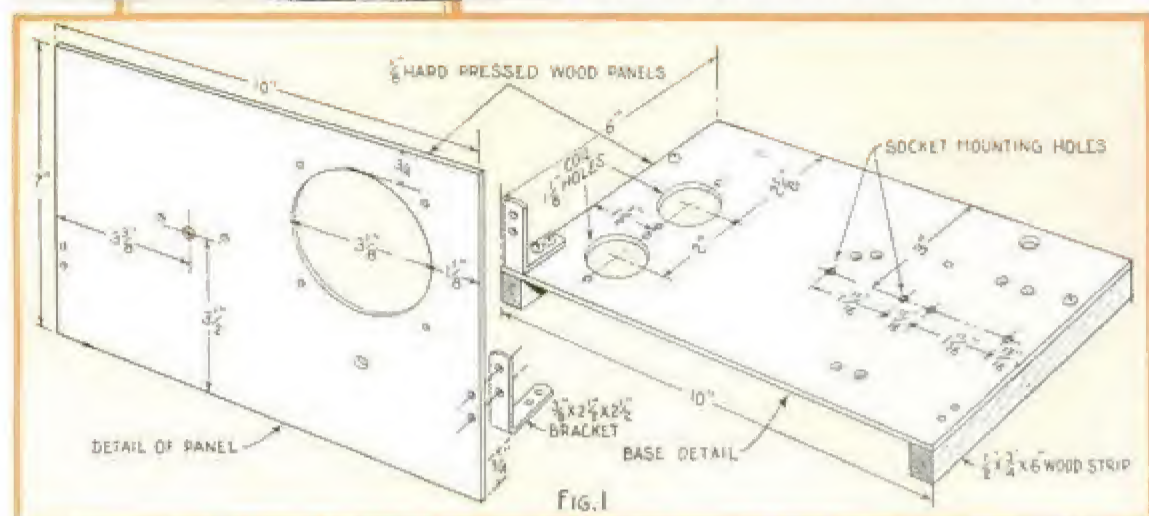
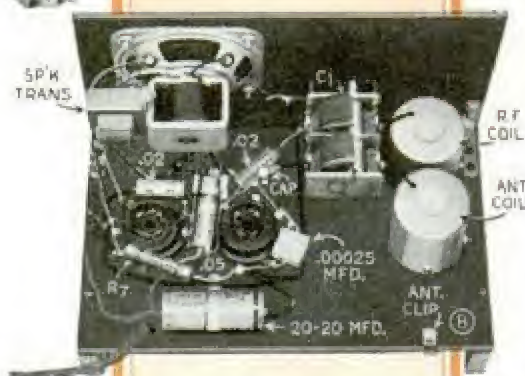
TWO TUBES EQUAL FOUR

By L. M. Dezettel

ECONOMY is carried to a high point in this efficient 2-tube tuned-radio-frequency a.c.-d.c. broadcast receiver which employs two double-purpose tubes in a simple layout on a nonmetallic panel and base. Performance equal in every way to that obtained with four ordinary tubes in a t.r.f. circuit is possible because of these standard double-purpose tubes, which were developed for use in midset sets of unusually compact design.

Good selectivity, tone and volume are features that will please every radio experimenter. The 12B8-GT is an r.f. tube having a 12-volt filament and a separate pentode and triode section. The pentode portion of this tube is used as an r.f. amplifier and the triode portion as a grid-leak detector. It will be noted that the 32L7-GT is a combination half-wave rectifier and beam-power audio output tube which operates on 32 volts; the output section delivers power sufficient to drive a small speaker to full room volume. The circuit is designed for easy wiring, with no frills or tricks. All parts are standard inexpensive items, many of which will be found in any radio experimenter's assortment of used parts.

Hard pressed wood is used for both base and front panel. This 1/8-in. material is easily worked, and can be obtained from your local dealer in building materials; all construction details are given in Fig. 1. Photos A, B, C and D show front, top and



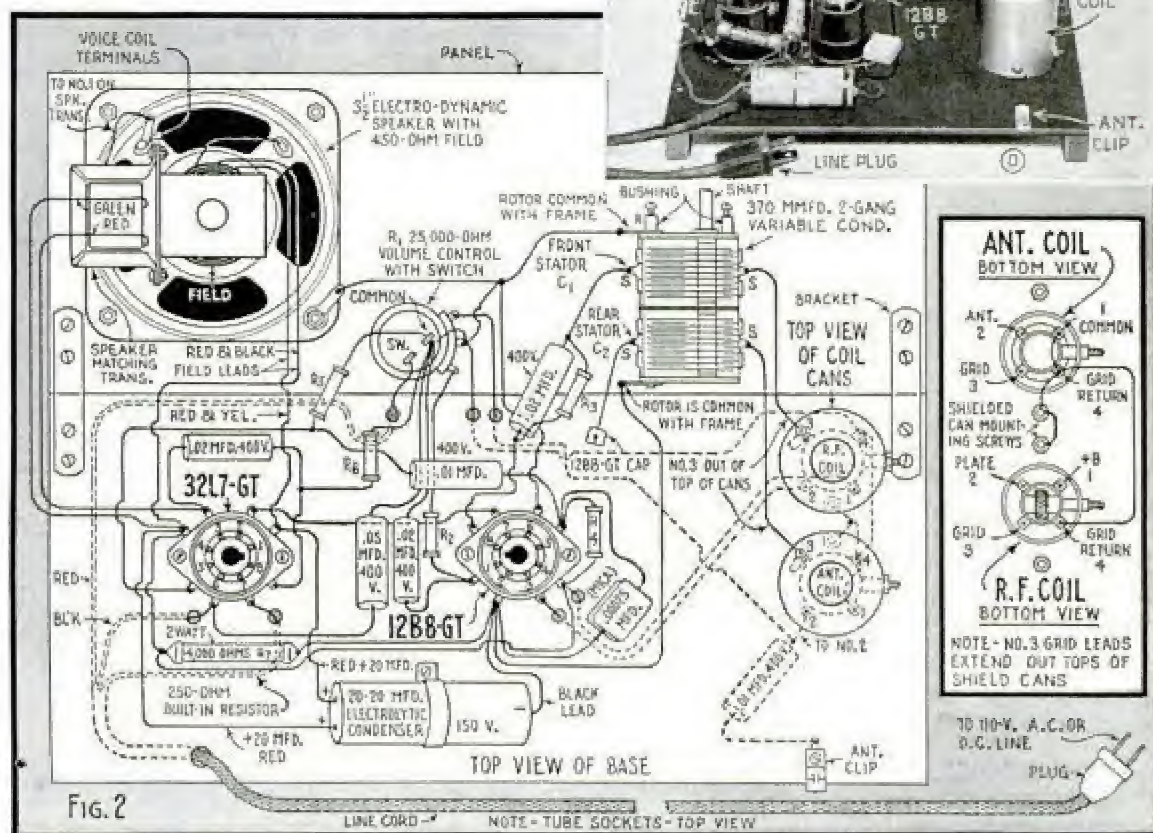
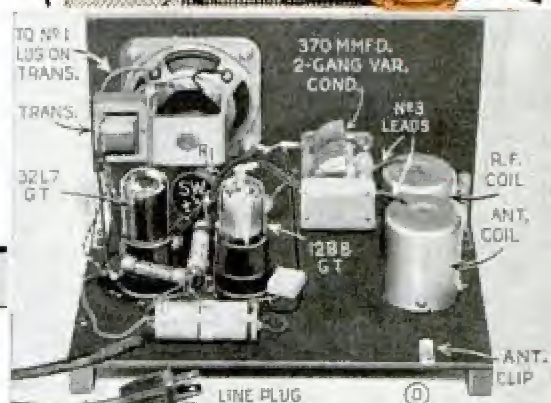
IN THIS ECONOMY T.R.F. SET

underside views. These photos, together with the simplified wiring diagram, Fig. 2, show all leads and connections with one exception; this is the voice coil lead which goes to the No. 6 lug on the universal-type speaker transformer and this terminal is hidden from view on the opposite side of the transformer. The schematic circuit diagram appears in Fig. 3.

The electro-dynamic speaker is fastened directly over a large hole in the front panel and backed with a piece of grille cloth. A 2-gang variable condenser with trimmers, is mounted by means of two $\frac{1}{2}$ -in. bushings and two $\frac{3}{4}$ -in. machine screws. Although the base panel is raised, most of the small parts are mounted on top as the tube sockets are of the base mounting type.

Assemble all of the parts carefully and wire slowly. Short leads and well soldered connections make a world of difference. Because a metal chassis base is not used, the antenna and r.f. coils must be of the shielded type. These coils may be either "Carron" S-523 and S-519, or "Knight" 60-555 and 60-556, or any similar shielded

(Continued to page 183)

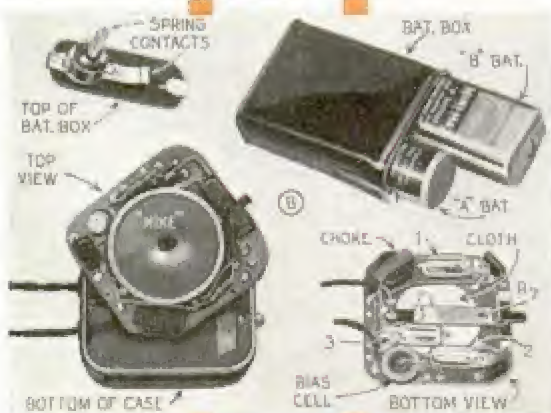


Microtube Laboratories

Three "Microtubes" in Wearable Hearing Aid

2414 Lawrence Ave
Chicago

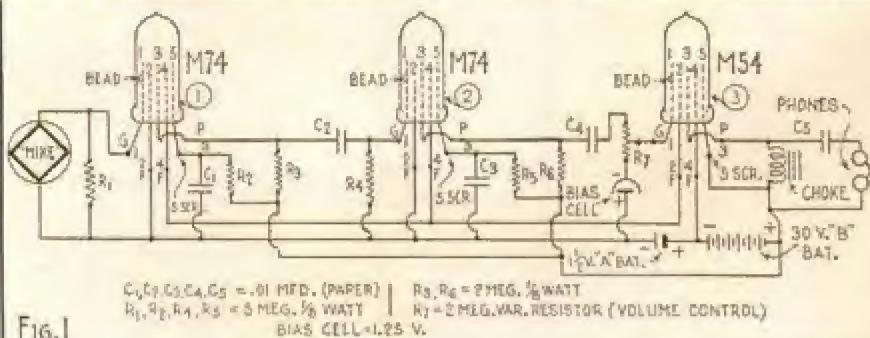
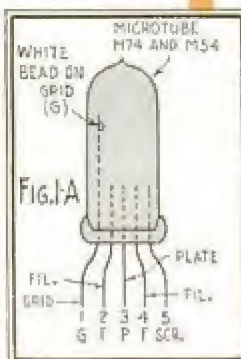
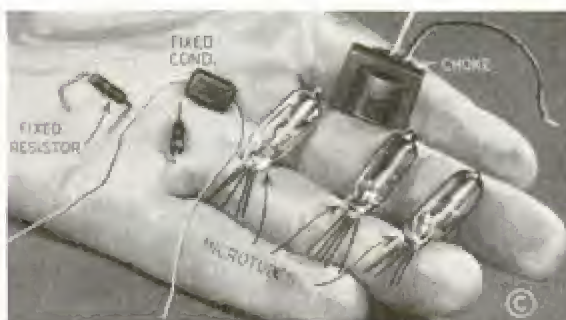
By Edwin C. Ewing



THIS inexpensive 3-tube audio amplifier is housed in a metal case no larger than a typewriter-ribbon box. It fits easily in the vest pocket, or it may be clipped to the clothing as shown in the photo at the left. The battery container is quite small.

An excellent performer, it is helpful in any case where the degree of hearing deficiency has not progressed to a point where similar vacuum-tube hearing aids are not useful. Photo A shows the assembled units, and photos B and C the component parts that are available in complete kit form. The low-drain "microtubes" are familiar to the readers of Popular Mechanics Magazine as they were employed in the tiny 3-tube receiver R-297 which appeared in the December, 1941, issue.

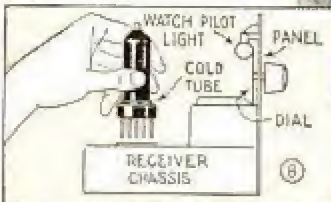
Although this hearing aid amplifier is easy for radio craftsmen to build, it is not recommended for beginners. The chassis comes formed and fitted with the necessary eyelets, ready for installing and adjusting in the housing. Soldering should be done with a pencil-type iron and care taken in following the assembly details which are supplied with the kit. The schematic circuit diagram, parts values and tube chart are given in Figs. 1 and 1-A. Fixed resistor R_1 is included in the microphone unit.



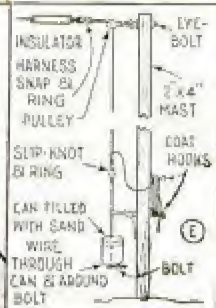
Practical

RADIO SUGGESTIONS

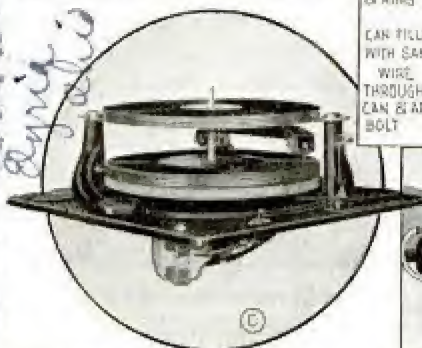
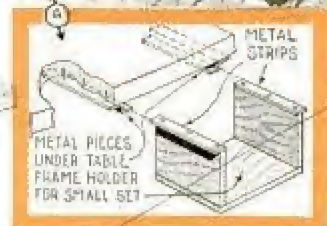
(A) This protective and space-saving set holder, mounted under the lawn table, may be arranged for any small portable or table-model receiver. A.C.-D.C. sets can be powered by means of an extension cord out a nearby window, for temporary use. The sliding open-frame holder provides a means for installing or removing the set quickly and holds it in a convenient position for tuning



(B) Emergency check for locating a burned-out metal-type tube; remove suspected tube, later insert quickly; if pilot light does not momentarily dim slightly, tube is burned out



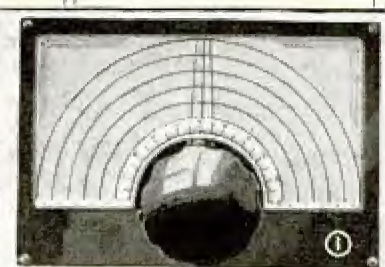
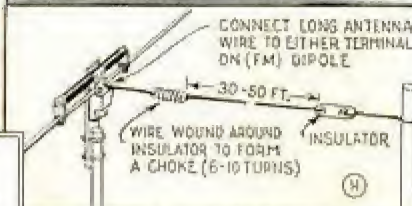
(E) Counter-balance keeps antenna wire tight. (F) Universal replacement type power cord resistor for repairing a wide variety of a.c.-d.c. sets



(C) Record changer has means for guiding needle into playing groove on records without lead-in groove. (D) Figs. 1 and 2, swivel auto antenna adjusts to vertical



(G) Automatic wire solder feed attachment permits one-hand soldering. (H) To increase AM pickup on an FM-AM dipole antenna, add long wire at right angles as shown. (I) Dial has 5-range scale for hand-calibrating ultra short-wave receiver. (J) Homemade P.M. speaker case has rear compartment for long cable



Cambridge Elec. Prod. Inc. 490
 Electric Supply Corp. 705 W. Jackson
 Charles E. Miller 285 7th St. Brooklyn
 Sherman: Miller 61 Sherman

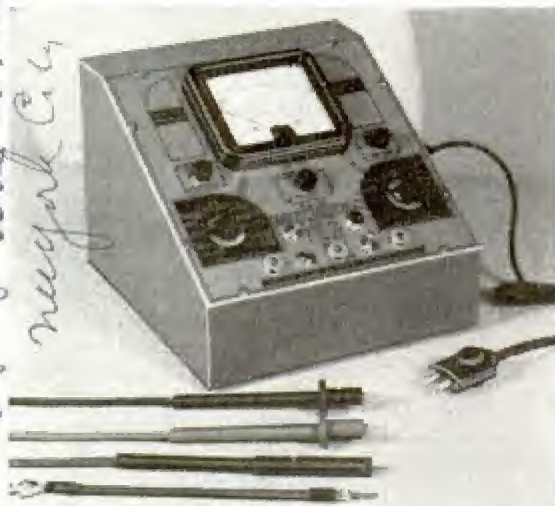
Versatile Robot Raid Warden Controls Alarms and Lights



Tuned to any key radio station, this compact instrument automatically switches off unattended lighted signs, show windows, etc., and also sounds an alarm for employees or residents. It may also be employed to turn on safety blackout lights.

Multi-Purpose Test Meter

Designed for wide application in radio and electrical measurement work, this meter provides a total of 27 measurement



NEXT MONTH—"Beginner's Special" One Tuber Works on 6 Flashlight Batteries. This extremely low-cost broadcast receiver is the first unit of a series in which most of the same parts are used. It employs a type-1Q5-GT tube and a homemade coil wound on the cardboard case of a flashlight cell. Also—**Home Set Service—Part 2.**

ranges to take care of voltages, both a.c. and d.c., up to 6,000 volts; resistance to 1,000 megohms; capacities to 2,000 microfarads. The low ranges for each of these types of measurement are such that values as low as 0.1 volt, d.c.; 1.0 volt a.c.; 0.2 ohms and 30 micro-microfarads can be read directly from the meter scale without estimating fractional scale divisions.

Two-Way Antenna Is Pre-Tuned

Supplied with universal mounting for auto or marine use, this pre-tuned antenna provides increased signal strength for two-way radio communication. An adjustable coil may be tuned to the frequency used, thus overcoming power loss due to lack of



antenna length. It is recommended for use in ambulances, fire equipment, boats, military vehicles, police and patrol cars. Dead spots are eliminated, and coverage over terrain normally unfavorable to radio transmission is greatly improved.

Blueprints covering simplified radio construction articles in this and past issues are available for 25c each. Many popular tested circuits to choose from. Original detailed parts lists with names of supply sources, can be obtained from Popular Mechanics Radio Department upon receipt of postage.



Grand-Prize Winner
(a \$1500 award)

Newspaper National Snapshot Awards

Photographer: LUCIEN GAGNON

Film: Kodak Panatomic-X

KODAK PANATOMIC-X FILM, with which Mr. Gagnon made his picture, is an extremely fine-grained, high-quality panchromatic film of moderate speed and contrast. Particularly valuable when great enlargement is intended or when very fine detail or texture is desired. Rolls, packs, sheets.

There is a Kodak Film especially designed for every picture-taking purpose . . . Meet the complete Kodak Film Family at your Kodak dealer's . . . Eastman Kodak Company, Rochester, N. Y.

The Great Pictures are made on KODAK FILM

Fishing for Vitamins

(Continued from page 4)

lowed to retain the vitamins in food. Since vitamins B and C dissolve easily in water, as little water as possible should be used in cooking. This water should then be used for soups and vegetables instead of being thrown away. If vegetables are to be boiled, the water should be raised to the boiling point rapidly. Vegetables that are cooked in their skins retain large amounts of their vitamins.

Don't stir air into foods while cooking, don't use soda in cooking vegetables, and don't sieve foods while they are still hot. Foods that are high in A, B, or C should not be fried. Storage destroys vitamins, hence fresh foods should be eaten before they become wilted or stale. Cooked foods should be eaten at once instead of standing for hours, and leftovers have small vitamin value. Modern pressure cookers are extremely good.

Orange juice should be squeezed just before serving, and salads likewise should be prepared just before the meal. Most canned foods retain a good proportion of their vitamins and quick freezing is another storage method that helps preserve these substances.

Today some foods are being fortified with vitamins. Some brands of milk are enriched with vitamin D, oleomargarine is enriched with vitamin A, and some brands of white bread now contain vitamin B as well as other needed substances.

Science has learned how to manufacture most kinds of vitamins artificially hence they can be had in relatively unlimited amounts, but vitamin A must still be obtained from natural sources. That explains the recent rush to find a substitute for cod liver oil. The fact is that the livers of many fish, including halibut, rock cod, mackerel, and tuna, are rich in the vitamin. Even sardine oil contains A and is used as such to fortify the feeds of domestic animals.

Not long ago investigators thought they had discovered an additional source of vitamin A that was as good as soupfin shark liver. They were making tests on the liver oil of giant sea bass and in the spectrometer the oil looked to be rich in the substance. As a check they then fed the material to rats, but the animals failed to respond in the expected manner. Now it appears that the giant sea bass contains a fake vitamin

and that its quantity of the true vitamin is fairly low.

Fishermen have been getting rich at shark fishing but the gold rush is over now, so forget about heading for the nearest coast to make a fortune. It will cost you several thousand dollars at the very least for a boat and gear, after which you will be just another fisherman who is wondering where the fish and sharks are today. So far, shark fishing has been spotty because, not being desirable in the past, they have been given very little study. When a shark got tangled up in a net the fishermen usually killed it and threw it overboard. The soupfin has been the exception because its fins, valued by Orientals, are worth saving, and fillets of meat are taken from its sides for the fresh fish market. The balance of the carcass goes to a reduction plant to be ground up as fish meal.

Today sharks are being sought for their own sake on both coasts. They are fished for with gill nets that are drifted below the surface or set on the bottom, or else trawl lines baited with sardines are used. To the public the shark has been notorious as the ruthless killer of the sea but the commercial fisherman has always known him as a worthless pest. Today both the public and the fishing industry are profiting by the vitamins that sharks store up.

What to Do About Scratches In Mahogany

Very light scratches in mahogany furniture often can be made less conspicuous by painting with iodine or mercurchrome, depending on which is the best color match. Apply with a fine paint brush, let dry and then wax. For deeper scratches, buy a shellac stick to match as closely as possible. Begin by dampening a cloth pad in alcohol and rubbing it crosswise over the scratch. The alcohol will soften the finish, smoothing the sharp, broken edges. Soften the shellac stick over a match or spirit lamp and work it into the scratch with a warmed flexible knife blade or spatula until the opening is filled. Then smooth the surface with very fine sandpaper and apply a coat of wax. Should your first attempt be unsatisfactory, you can remove the shellac with alcohol and start again.

AUTO-LITE SPARK PLUGS

Presents the *MOUNTAIN BOYS* by P. W. E. B. D. -



"MIGHT BE A SMART IDEE TO MOVE PAW'S HEAD OVER A LEETLE, LUKE...MEMBER SHE STARTS OUT LIKE A JACK-RABBIT SINCE MAW GAVE 'ER A PLUG-CHEK"

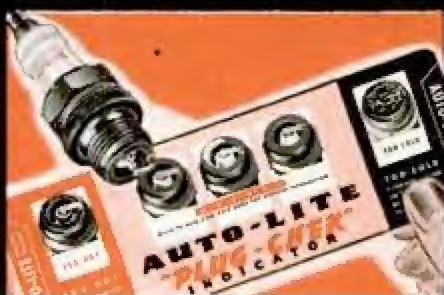
"SPARK-WEARY" ENGINES GET NEW LIFE

Take a tip from the Mountain Boys! See with your own eyes why your car is sluggish, hard on gas. Auto-Lite's new "Plug-Chek" inspection service helps spot gas and power-wasting plugs. Cleaning and regapping your present plugs often restores "like-new" economy. Replace faulty plugs with ignition engineered Auto-Lites.

THE ELECTRIC AUTO-LITE COMPANY

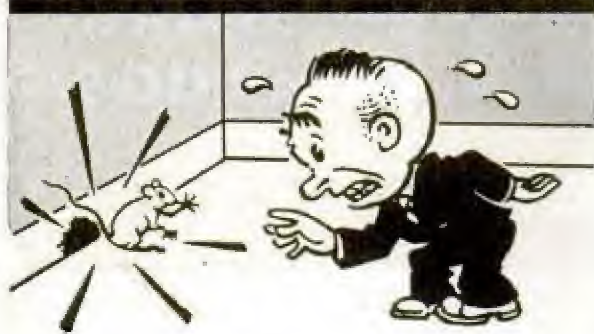
Toledo, Ohio • Merchandising Division • Sarnia, Ontario

In its 26 Great Manufacturing Divisions, Auto-Lite is Producing for America's Armed Forces on Land, Sea and in the Air



Color and condition tell if plugs are operating properly. Matching your plugs with those illustrated on the "Plug-Chek" is first step in restoring new life to spark-weary engines.

IF YOU'RE IN THIS FIX..



P. W. WILL FIX IT

HOLES AND CRACKS in floors, base-board, or woodwork can be easily and quickly repaired with **PLASTIC WOOD!** Takes a finish like the original wood. Get it at Paint, Hdwe., and 10¢ Stores.



HANDLES LIKE PUTTY—HARDENS LIKE WOOD

Mows and Trims Lawns

**in One Simple,
Easy Operation**



**Save Time
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MONTAMOWER**

Tired backs and aching arms just don't happen to users of Montamower. All the drudgery and noise of lawn mowing is done away with. No dead weight to push and pull. Instead, just 7 pounds of live mechanism that first gathers then cuts the grass closely, smoothly, and to the correct height; no matting; no streaking; no clatter; no rattles. Cuts a 16" swath through long grass, dandelions, spike grass and weeds. Cuts right up to walls, fences, trees or posts; leaves no fringes to be trimmed by hand. Cutters are self-sharpening. Built to last many years. Guaranteed. Thousands in use. Sold direct from factory. Costs little. Write at once for guarantee information and literature.

MONTAMOWER DISTRIBUTING CO.
329 Houseman Bldg. GRAND RAPIDS, MICHIGAN

Dogs of War

(Continued from page 11)

receiver. Responding to the radio commands, the dog obeys just as rapidly and accurately as if his trainer were beside him.

Armies in Europe have trained dogs to do many valuable duties. Finland, for instance, has a dog reserve in which the members are trained for service under battle conditions. Some of them are taught to operate while wearing gas masks. Dogs are reported to be used in England for guarding the invasion coasts, where their keen senses are especially useful during heavy fogs. It is said that Russia has a dog corps that is dropped by parachute along with regular paratroops for messenger work in the field.

Being smaller and faster than a man, a dog makes a useful messenger that can cross open country with less danger of being hit. During the first world war one dog is said to have covered the three kilometers between posts 30 times in one day, traveling back and forth with messages in a container strapped to his back. Some of Spitz' dogs have learned similar duties and are able to make their way from one point to another as far as three miles distant and even across strange country.

A dog is twice as strong as a horse, relatively, and many of them have long and honorable military records for carrying cartridges and food to isolated outposts. Occasionally they have packed a cage of carrier pigeons that were later used for dispatching messages back. Carrying reels of light telephone wire, dogs have laid long stretches of communication networks. When the reel is attached to a light cart behind the dog he can pull a load that weighs upwards of 150 pounds at the start of the trip.

Another chapter in the story of dog's usefulness during war concerns his Red Cross work. A dog that is trained for this service abroad can seek out the wounded on a battlefield, stand by while an injured man helps himself to the supplies carried on the dog's back, then return to headquarters and lead a stretcher party back to the man he has found.

¶To learn where to buy commercial products described in these pages, see the index.

Clothespin as Mending Mark



Keep a few spring-type clothespins at hand when you are ironing. They are handy to clip over a garment to serve as a reminder that it needs mending. The marker will show at a glance where the repair is to be made.

Solutions to Clean Concrete

I used the following method with excellent results for removing rust stains, automobile oil and grease spots from my concrete driveway. To remove the rust stains, I dissolved sodium citrate, 1 part, in water, 6 parts and added commercial glycerin, 6 parts. Mix this (a portion) with enough powdered whiting or chalk to form a paste, and spread it in a thick coat. When dry, replace with fresh paste or moisten with the remaining liquid. A week or more may be required to remove the stains. To remove fresh oil stains cover them with an inch or two of dry portland cement. For old stains wash with a solution of trisodium phosphate, 2 lbs. to the gallon of hot water. After cleaning remove all traces of the solution by rinsing with clear water.

—Paul Astrella, Dorchester, Mass.

Lubricate Rubber-Band Motor For Long-Range Flights

Your model airplane will fly about twice as far if you lubricate the rubber band motor with a solution of liquid green soap, 3 parts, and glycerin, 1 part. This solution will make the elastic stretch about twice as far as normal.

—Herb Arrall, Newburyport, Mass.



AIDING BY SAVING



Any tools which help to *make things last longer* contribute valuable savings toward winning the war . . . by making more guns, ships, planes, tanks and supplies available for our Armed Forces.

If you are a repairman—auto, tractor, household appliance, farm or shop machinery—you are serving valiantly in this great conservation effort. . . . And finding yourself gainfully busy besides!

Among your most essential tools are *files*. And your best buys today are Nicholson or Black Diamond brands. They're quality files that give you the maximum number of efficient work strokes per file or per dollar. They're used in thousands of industrial plants; preferred by most experienced mechanics. They carry the guarantee of *Twelve perfect files in every dozen*. Obtainable through hardware and mill-supply houses.

NICHOLSON FILE CO., 23 ACORN ST.
Providence, R. I., U. S. A.

(Also Canadian Plant, Port Hope, Ont.)

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FILES FOR EVERY
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NICHOLSON
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FREE TECHNICAL BULLETINS on Special-purpose Files for Stainless Steel, Aluminum, Brass, Plastics, Die Castings; Die Making; Foundry, Shear Tooth and Lathe filing. Name ones wanted.



OUTDOOR FUN!



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SPRING FRAME MOTORCYCLE

Exclusive "Spring Frame" smooths out roughest country roads. New comfort, safety. Brilliant streamlined beauty. See your Indian dealer.

INDIAN MOTORCYCLE CO., SPRINGFIELD, MASS.

ATTENTION! DEFENSE WORKERS

FOR 27,000 R. P. M. INSIST ON A GENUINE

MOTO TOOL

100 Tools in One

- *Has shock-proof bakelite case.
- *Fan-cooled motor can't overheat.
- *Has oil-less bearings.
- *Dynamically balanced armature.

Here's guaranteed quality! The handiest tool in the shop or home. Use it daily for model making, repairing, carving wood or plastic, etching glass or metal, turning up dies, whetstones, routing, sanding, drilling, and on a hundred other jobs. Higher speed does better work and saves cutters. Model One, #1, 6 in. with chuck and 1/2" collet, only \$9.95. Model Two, #2, 12 in. \$16.50. 16 DAY TRIAL—Money-Back Guarantee. If your dealer does not have Moto Tool, order direct... we pay postage if you send cash. Or, send only \$1, pay postman balance plus postage. New catalog of tools and accessories FREE.



KIT NO. 1 with 23 high grade accessories and Model 1 Moto-Tool in \$17.50 hardwood case

KIT NO. 2 same as above with Model 2 Moto-Tool... \$23.50

DREMEL MFG. CO.
Dept. T-112-F
Racine, Wis.

PUSH BUTTON CONTROLLED GAS TANK LOCK

NO KEYS—Electrically operated from dashboard. One model fits all cars including fender door type. Greatest thing out! Sell on sight! Fully guaranteed. Distributors, dealers, here is your money making opportunity. Rush name for free literature.

SNAP-UP GAS CAP CO. Dept. K. **ASHLAND, KY.**

BE PREPARED! LEARN TO SHOOT WITH BENJAMIN

MADE IN U. S. A.



LEVER HAND PUMP anywhere, for practice firing or just plinking, around the house or camp, fishing, hunting, etc., at lowest cost. Shooting force is adjustable with amazing maximum power and accuracy—no recoil or forward lunge to disturb your aim. Bolt Action—Hammer Fire—Hair Trigger—Safety Lock—Hand Pump. Single Shot BB with 1 lb. shot \$9.00; Single Shot Cal. .177 or .22 rifled—with 500 pellets \$10.50. Also a complete line of improved **BENJAMIN GENUINE COMPRESSED AIR TARGET PISTOLS**. "No License Required." Write for details and **FREE TARGETS**. **BENJAMIN AIR RIFLE CO., 295 Marion St., St. Louis, Mo., U. S. A.**

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Tests Everything Electrical From 100 to 550 Volts

A real necessity for electricians and home because it has 1001 uses. Equipped with a Neon light which tells instantly where trouble lies in electric circuits, fuses, cut-outs, motors, radios, all kinds of electric appliances, etc. Tells A. C. from D. C. Far superior to ordinary clumsy test bulb. Fountain pen size with clip for carrying in vest pocket. Lifetime guarantee.

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55 Dickerson St., Newark, N. J.



APPLIANCES



MOTORS



FUSES

If You Can Drive You Can Fly

(Continued from page 75)

miles an hour," Eddy said, but I was too absorbed in watching the ground come at me to give the dial more than a swift glance. The angle looked steep to me. The Skyfarer liked it better than I; its flaps permit a steep climb and steep descent, although the actual angle of the plane is not steep.

My stomach tied a fresh knot in itself, my legs were pushing the floor away from my face, and the little steering wheel winced in my grasp.

Just above the cinders Eddy gave the command: "Now pull her up level."

I did, and we were down, three wheels rolling swiftly down the field, no bump, no skid, no careening. No one was more surprised than I. Gentle pressure on the foot brake slowed us down, and with a turn of the steering wheel the front wheel led us off the runway. Stomach, untie yourself.

Now I am not going to claim that I'm a "natural" airman. The truth seems to be that Prof. Otto C. Koppen of Massachusetts Institute of Technology, vice president of General Aircraft Corporation and designer of the Skyfarer, has developed a "missing link" between motoring on the ground and in the air; a plane that any driver with ordinary coordinative ability and good sense can step into and learn to fly in a couple of hours. Its control wheel puts the motorist at home; on the ground it steers the front wheel of the tricycle landing gear; in the air it steers the plane by its ailerons, also operates the elevator. The twin tail assembly is rudderless, its fixed fins of patented design preventing any side slip. I rather expected to make a poor landing and feel the plane skid around or ground loop as youngsters do on a poorly balanced tricycle. In six or eight landings—I lost track—the craft never failed to set itself down on three wheels and roll straight ahead, the center of gravity (just forward of the pilot's body) pulling the rear wheels evenly. Once, paying too much attention to a plane nearing the runway on the ground, I leveled off six feet up and dropped her with a bump. Still, there was no bounce and Bud Eddy comfortably said the Skyfarer had been dropped in from 20 feet up without damage.

Back to earth, I had time to revise my notions of flying. Having expected to be

2920

busy constantly jiggling the stick to keep the ship level in bumpy air, I was pleasantly surprised that it hadn't been necessary. Agreed, the air was not especially turbulent; but stability was built in, and the less control by the pilot, the better.

After an hour of ups and downs I told Bud Eddy I'd like to make one more flight, and this entirely without help from him.

"Why," he said, "you've made at least four good landings without my touching the wheel. But go right ahead."

So we did, and I did. Qualms about the takeoff had disappeared after the first trip; turns had become pure fun and Eddy was kind enough to call them perfect; I knew what to do with the flaps, and when, and was automatically compensating with the elevators while adjusting the flap position; I could even watch the air speed indicator and keep it at 55 on the way up, 70 on the way down. I could relax and lean back when Eddy reminded me to unstarch. But as a matter of fact my stomach has a way of tying itself in knots whenever I drive my automobile above 60 miles an hour, and it was taut all the way home from the airport in that Sunday afternoon's traffic.

Well, when they build a plane so safe and stable that an average motorist like myself feels confident he could solo in less than two hours, they've got something that should put folks in the air as flivvers put them on the road.

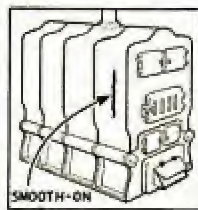
At this writing, General Aircraft's Skyfarer and the Ercoupe, a low-wing craft, are the only two planes approved by the Civil Aeronautics Authority as incapable of spinning. The Ercoupe has better visibility above and behind, the Skyfarer better visibility below. They differ somewhat in flight characteristics; the Ercoupe has no rudder pedals, but has rudders coordinated with the ailerons.

Its four-cylinder, horizontally-opposed, geared Lycoming engine of 75 horsepower will drive the Skyfarer at top speed of 100 miles an hour, cruising at 92. It takes off in 350 feet at 45 to 55 miles an hour, lands at less than 60 and stops in 150 feet. Its range is around 400 miles on 20 gallons of gasoline. You fly for a cent a mile.

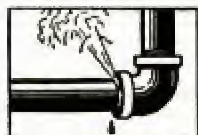
The exciting thing about it is that if I can fly it, you can. Next month we'll thumb a ride in a conventional lightplane and learn what makes it tick.

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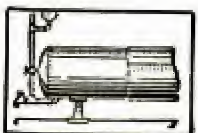
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New Disguises of the Demon Fire

(Continued from page 54)

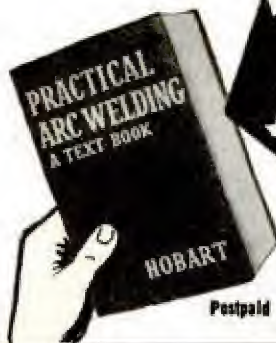
driven by vaporproof motors that help exhaust the vapors from the painting rooms. In addition there are curtains of flowing water along the walls that pick up and carry away the particles of pigment blown into the air. Douglas dopers and painters work in rubber-soled shoes and, on entering a paint room deposit all matches they may be carrying in a special receptacle.

Painting is always safest when it is done in the open and if a job must be done indoors, doors and windows should be left open for good ventilation until after the work has dried. Even the pilot light of a water heater was enough to explode the gases rising from fresh paint in another room in one case in which two women were seriously burned.

Fortunately there are no special fire hazards in the new plastics that are coming on the market although many of the common semi-plastics are regarded as dangerous. These semi-plastics include some of the imitation ivories, celluloids, and similar compositions such as are used for cheap fountain pens and some toilet articles. To test what you are buying, use a knife to scrape a thin shaving of material from the bottom of the object and then touch a match to the shaving. If it flashes, the material is hazardous. Never lay a hot electrical appliance on semi-plastic material. A fire may even occur if you lay a celluloid comb on a hot steam radiator. Even the rays of the sun, concentrated by an air bubble in a window pane, have caused imitation ivory articles to ignite.

Ridding Garden of Moles

Home gardeners who are troubled with moles have cleared them out completely by putting up some kind of a wind-driven garden ornament, or better still, several such devices about their premises. Anything from the toy windmill whittled by a small boy to a more elaborate flying duck or whirling daisy sold by seed stores proves effective. Rattle and vibration from wind-driven ornaments transmitted to the earth through supporting stakes provides enough unusual commotion to drive moles considerable distances away from the locations of such ornaments.



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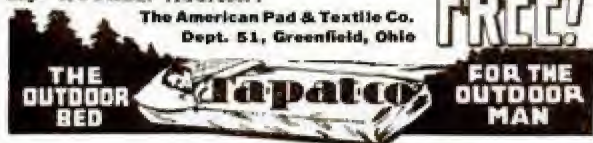
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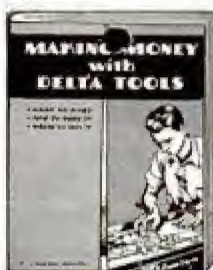
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2/082-

Piloting Tom Thumb Water Bugs

(Continued from page 69)

than the one before. All changes in hulls and motors are tested by means of a water pressure speedometer.

Half a dozen coats of varnish, rubbed down, seem to be the fastest surface for the bottom of the hull. Most of the varnish will be worn away after a day of racing and must be renewed.

Even when a driver has his outfit tuned to the peak of perfection a slower boat may beat him if his opponent is a more experienced driver. A good driver can beat a faster boat by running in the speed groove on the turns instead of turning too widely or too sharply. Another place where experience counts is in the clock start. If a driver can hit the starting line at full speed just as the 6-foot starting clock registers zero and the starting gun is fired, he has a long lead over drivers who had to slow down behind the line to avoid crossing it too soon. A boat that crosses the line ahead of the starting signal is disqualified.

Smooth water is slower than water with a slight chop on it, as drivers can tell from the feeling that brakes are being applied when they happen to hit a patch of slick, calm water on the course. Raising the motor a couple of inches on the transom helps keep the speed up when a race is being run in still water.

There is no money in racing the midgets. The larger classes of outboards, ranging up to big 225-pound runabouts that carry a two-man crew and are powered with 55-horsepower motors, provide trophies to amateur winners and cash prizes to professional winners. The midgets are strictly an amateur class so trophies alone go to the winners. But professional drivers like them enough to forsake cash prizes and race for cups.

Light Solves Blackbird Problem

After several other methods had failed to frighten away thousands of blackbirds roosting in a tree adjacent to a private home, the owner used a 200-watt electric lamp. This was fastened in the topmost branches of the tree and connected to the home current supply by means of a long, waterproof extension cord. The blackbirds have not returned to roost in the tree of perpetual daylight.

Bent Paper Clip Pulls String Through Notebook Sheets



It's an easy matter to thread string through a stack of punched notebook sheets if you use an ordinary paper clip bent as shown. All you need to do is insert half the clip through the stack, hook the string in the lower loop and pull it through.

Bed Springs Reinforce Concrete

When the amateur mason contemplates a slab, pool, or base of concrete he logically thinks of reinforcing it with poultry netting or odd pieces of scrap iron. Neither is satisfactory, the netting because it lacks strength, and the iron because it does not tie together the whole mass of concrete. Old flat bedsprings of the individual coil, woven, or metal-strip type are one of the best substitutes for the regular bars or grids. If not found on a dump the spring can be picked up cheaply at second-hand shops. For thin slabs the frame should be removed. In making a tank the spring or springs should be arranged so that part will be in the bottom and the remainder bent up into the sidewall forms. This effectively ties the bottom to the sides. If the area of concrete is large enough to require more than one spring they should be overlapped slightly.

—R. C. Roetger, New York City.

Steaming Planks With Blowtorch

After completing the framing of a small sailboat, I was confronted with the problem of bending planks of $\frac{5}{8}$ -in. redwood. Not having the facilities for regular steam-box technique, I soaked the planks with water, sprung them in an arc against the garage and used a blowtorch for the steaming-in operation.

—James W. Milnor, Oyster Bay, N. Y.



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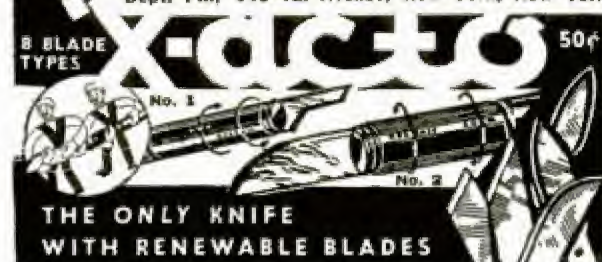
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Tarnished silverware can be cleaned easily by the electrolytic method, which consists of boiling it in an aluminum pan. Use a level teaspoonful of salt and a like amount of baking soda (or simpler, 2 teaspoonfuls of salt alone) in a quart of hot, but not quite boiling, water. Use a bright pan, and immerse the silver. Do not use on French gray or oxidized finish common in ornate patterns or on such objects as silver candlesticks or pearl-handled table knives, which are made of parts that are either held together or weighted by cement. More rapid results are obtained with the electrolytic method if a piece of bright copper or tin is placed in the solution below the silverware. An enamelware instead of an aluminum pan may be used, but in this case, put pieces of bright zinc and tin together in the pan, being sure that each piece of silverware is in actual metallic contact with the metals, either directly or through other pieces. After the silver is clean, wash and polish with a soft cloth or, if necessary, with a mild abrasive such as whiting. To avoid development of a dull or matt finish and the necessity of polishing with whiting after the electrolytic treatment, silverware should be cleaned before it becomes too tarnished. If an aluminum pan is used, the pan should be clean and bright; it soon becomes dull from the chemical reaction and must then be cleaned. The zinc or tin, when used, should likewise be bright; either may be cleaned by using scouring powder or by rubbing with sandpaper or emery cloth.

Repairing Finger Marks in Paint

How often have you finished a job of painting only to have someone put a deep fingerprint on the finish when the paint or enamel is just firm enough to prevent neat touching over? The print, in nearly every case, may be removed in the following manner: Being sure that your fingers are clean, wet your index finger in clean water and dampen the marred surface of the paint. Using rapid and smooth movements, massage the surface of the paint with the damp finger. The water prevents cohesion of fingers and paint, and allows you to remove all traces of the original mark by merely reflattening the surface to its former condition.



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Torture Chamber

(Continued from page 89)

under the machines prevent the shock from wrecking the concrete foundations.

These power producers, each 12 feet long and 18 feet high, can deliver the 2,000,000 kilowatts only five seconds at a time without danger of burning out. This surge or punch is like that which a power system receives when it is short-circuited. In one spectacular test, the generators are connected to two thick, curved pieces of wire called a horn gap. When the 2,000,000-kilowatt punch is released, it leaps the gap in a 20-foot waving, flaming, thundering arc as bright as mid-day sun and hot enough to melt instantly the hardest steel. When the same amount of power is shot into a 12-foot oil circuit breaker, only one-twentieth of a second elapses before the circuit breaker emits a mechanical grunt and blots out the flood of power quicker than you can wink your eye. In operation on a power line, this action disconnects the short circuited section, but permits normal operation of the remainder of the system. In another test, engineers combine ice and electricity to torture a four-foot outdoor power switch built for use in the sub-zero weather of Alaskan winters. This test is made in a room-sized refrigerator where temperatures of 20 degrees below zero are produced summer and winter.

Rotors of the two generators gain momentum for half an hour, until their surface speed is four miles a minute, before delivering the electrical knockout. When the short circuit switch is snapped shut, the generators instantly convert their stored mechanical energy into electricity. In addition to the generators, the power laboratory—"torture chamber"—also contains two switching boards, each 20 feet tall and studded with knife-type switches which are operated with long wooden poles. At strategic points in the power house are 10 photo-electric cells, or "electric eyes," guarding the machines and switches. Two men in a control room operate the generators and supervise tests through a system of communications much as a sea captain controls his ship from the bridge.

☞ Look in the index to find where to buy articles described in this magazine. Say You Saw It in Popular Mechanics.

The Revolution in Farming

(Continued from page 95)

Paralleling plant food studies is a research program to learn more about the mineral requirements of domestic animals. More knowledge about the iron and copper requirements of pigs, for instance, may lead to producing greater amounts of pork, once the right proportions of minerals can be supplied in the natural forage. Similar investigation may find a way of increasing the butterfat content of cow's milk.

What is going to happen to the surplus farm population now that fewer and fewer people are needed in the food industry?

Economists find the question a perplexing one although they have a number of answers that should help reduce such unemployment. One valuable suggestion is to increase the amount of food being raised and by a price adjustment arrangement make it available to low income families who now suffer from unbalanced diets. A good start has been made along this line.

Another partial answer is to stimulate the raising of fur animals as a profitable farming side line.

The greatest possibilities for farmers, now that our food demands are satisfied, lie in the raising of oils, motor fuels, rubber, raw materials for plastics, and other materials for which industrial uses can be found. Corn and soy beans have been exploited to some extent for this purpose although aside from cotton and wool, farming for industry is really a brand new subject.

Right now domestic rubber is of national importance and our small rubber industry is beginning to expand. A million pounds a year are being raised in California from a small desert shrub called guayule—pronounced Y-You-Lay. In its wild state this shrub has a rubber content of six percent but by careful selection and breeding this content has been increased to as much as 30 percent in the domesticated plant. Guayule can be raised in many parts of the semi-arid southwest. Exponents of this new industry think that some day the United States will raise all of its rubber at home.

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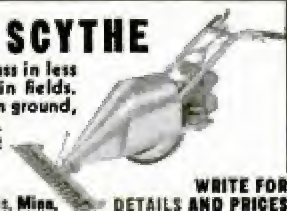
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Shoot Them in Color

(Continued from Coloroto Section)

ups can be lighted with two No. 2 photo-flood lamps, in handy cardboard reflectors replacing the shades in bridge type lamps, and the unit should be placed directly beside the camera and a little to the rear. The lamps should be about four feet from the subject's face, and a little higher than his head, but trained directly on him. If the subject is more than twelve inches from the wall, the background should be independently lighted, or the background color in the transparency will be too dark. More formal lighting requires several light sources; the amateur will find that various arrangements will lead to a number of attractive Kodachrome shots.

Most outdoor natural scenes have good color harmony, probably because the mind has grown to accept the color combinations of nature as harmonious and pleasing. In other scenes, color harmony—the effect on the eye to differences in color and the placing and relative size of colored objects—is left up to the imagination of the photographer.

The rule of loading and unloading your camera in subdued light—never in direct sunlight or exceptionally strong artificial light—is just as important with Kodachrome as with black-and-white negative materials. The small cylinder, in which the film is packed, should be retained for use as a container when sending the film to one of the Eastman Kodak Company's processing laboratories for conversion into transparencies. It is recommended that the film be processed as soon after exposure as possible. Keeping it for more than a few weeks in hot and humid climates results in faulty color because the image in one of the emulsion layers on the film may change more rapidly than in one of the others. Transparencies should be stored where they may be relatively cool and dry. They should never be kept near radiators, steam pipes or locations where they may be subjected to high temperatures.

There is no greater camera thrill than in taking pictures in full color. Careful attention to exposure and light, in addition to self training in color appreciation, will enable you to get excellent Kodachromes any time, anywhere.

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Line Drawing Made From Photo

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Saving on Typewriter Ribbons

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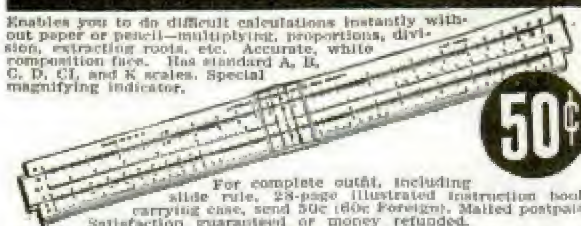


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What to Do Before Calling the Radio Doctor

(Continued from page 155)

probably has, your first thought is to call your local radio serviceman. Normally that is the proper thing to do. However, in the present situation this radio "doctor" may not be immediately available, therefore you can do a few things to solve the problem, which may not be as difficult as it looks. The very first thing to do is to remove the line-cord plug from the wall socket, even though you do nothing further.

As you have had this set for several years, you are familiar with the front panel controls, and probably know how to connect the antenna and ground. Now, with the receiver disconnected from the power line, have someone hold a flashlight so that you can see the various tubes on the chassis base, from the back of the set. Make sure that each tube is pushed down firmly in its socket, and that any leads running to caps on the tops of the tubes are in their proper positions, and that no bare wire, connected to these caps, comes in contact with the metal tube shields. Now examine the antenna and ground connections carefully, and, if everything appears to be right, push the receiver back in place and plug in the line cord. You may be surprised to hear the set again working properly which would be the case if a tube had been loose in its socket, or a grid-cap lead was shorting. On the other hand, if the set still refuses to work, immediately disconnect the line-cord plug from the wall socket, and leave it out. The next step, of course, is to remove all of the tubes so that you can take them to the radio store to have them tested. Now, unless you have a friend or neighbor handy who knows something about this procedure do not attempt to remove the tubes yourself, as right at this point many expensive receivers have been damaged although it is a very simple matter to remove them safely when you have once seen it done. Most modern receivers have a tube layout chart inside or under the cabinet, or the individual tube sockets are marked for the type of tube that must be used in them. If their positions are not identified in either way, it is necessary to remove one tube at a time, and mark each socket plainly.

(To be continued)



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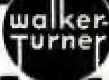
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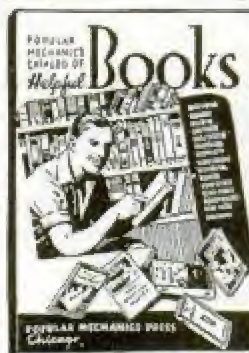


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(Continued from page 157)

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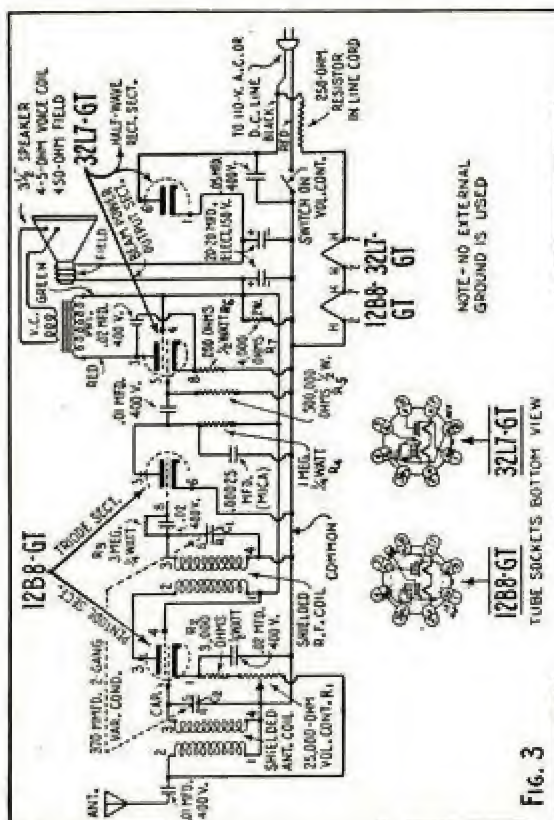


Fig. 3

tubes are connected in series, and a 250-ohm linecord resistor is used to drop the line voltage to the proper filament voltage. To test the set, turn it on and allow about 30 seconds for warming up. A short antenna is all that is necessary for powerful local stations; no external ground is used. For DX reception a 50 or 75-ft. outside antenna will give excellent results. Tune to a station at the high frequency end of the broadcast band (lowest wavelength) and adjust each of the trimmer condensers on the side of the 2-gang variable condenser until the station comes in with maximum volume. The set is now properly balanced for the broadcast band. Blueprint number for this article is R-304.

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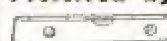
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